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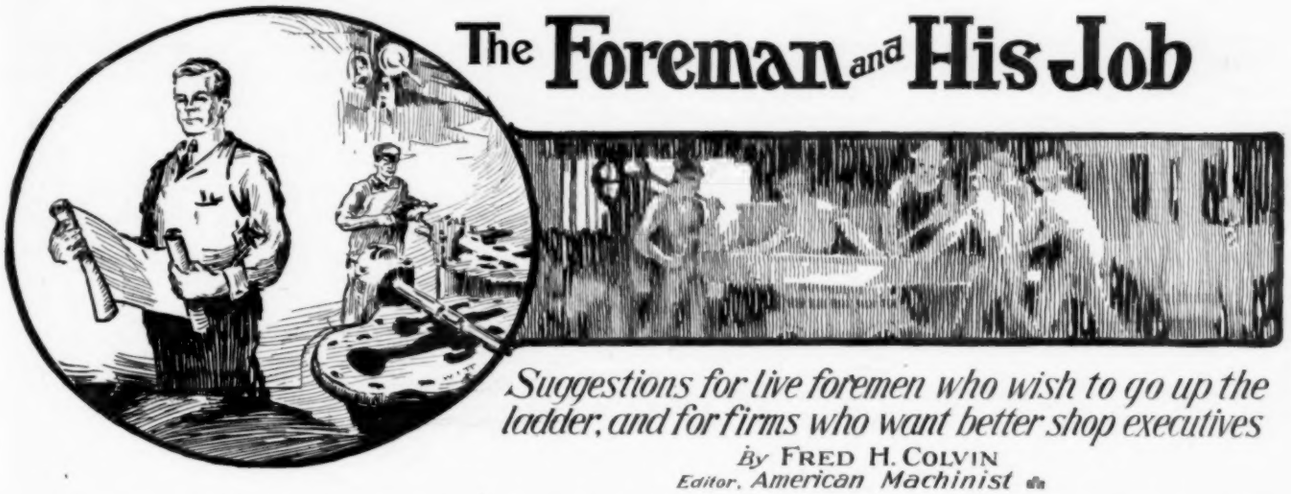
The Foreman and His Job



Suggestions for live foremen who wish to go up the ladder, and for firms who want better shop executives

By FRED H. COLVIN
Editor, American Machinist

THE great need of civilization today is the production of more and more of the necessities of life as well as of the things, not vital perhaps, but which go to make life more enjoyable. There is a growing need for machinery which will do more and more of the tiresome and laborious tasks which today make life a burden for countless thousands. These needs can only be satisfied by the safe and sensible direction of men along the line of most economical production. And the necessity for such direction only emphasizes the need of more thoroughly efficient foremen in all kinds of machine building shops. We must not, however, make the mistake of thinking that production is secured by studying machines and machinery alone. This has been the mistake of many efficiency engineers in the past. The most important part of a foreman's duties has to do with the relations to and the contact with his men. There are many instances where shops deficient in machine equipment, are producing work at lower costs than shops that are well equipped but which fail to secure the co-operation of their men. Here is where the foreman can play a most important part and the broadminded plant managers are beginning to appreciate the true value of the right kind of a foreman. The foreman's duties are many and they vary according to the system under which the shop is run. Both the foreman and the management, however, should thoroughly understand and appreciate that the foreman represents the firm to the men. He has the most intimate contacts and can do much to make or mar the good feeling that must exist if hearty co-operation is to be secured. If the foreman is tricky, harsh, unfair, or a driver, it is naturally assumed by the men that this is the attitude of the firm, while if the reverse is true, the firm gets credit for having all the virtues whether it deserves it or not. Unless both the management and the foreman thoroughly understand that real production depends much more upon co-operation than upon machines, methods and systems, neither will attain the fullest success. For while a knowledge of machines, of cost systems, of methods of payment; a study of the men themselves, the best way of handling them, which ones to encourage, which to criticize, and how; the best way of instructing in new methods is even more important. This phase of the foreman's duties and opportunities will be enlarged upon later. The old time foreman was a czar in his own shop or department. He could hire or fire at will, with no one to question his right to do exactly as he pleased. Personal, religious or political differences of opinion, grouches due to indigestion or domestic troubles; whims about the color of a man's hair or his place of birth, all played a part in holding a job, or in losing it. But czars are no longer in favor, either in the shop or elsewhere, and it is generally conceded that it is not a good thing for either a shop or the community in which it is located, to have the welfare or even the livelihood of its inhabitants depend on such a pre-

THE MOST IMPORTANT PART OF A FOREMAN'S DUTIES HAS TO DO WITH THE RELATIONS TO AND THE CONTACT WITH HIS MEN

carious basis. For we have learned that it costs real money to hire and fire men; not only in clerk hire, for that is a small part of the business; but in the time taken to train men and in the delay in production. This cost is estimated at from $25 to $250 per man, according to the kind of work. Even at a medium figure it is well worth considering.

The Employment Office

It was the change in ideas regarding hiring and firing that led to the establishment of employment offices and employment managers. And as with all changes of this kind it brought friction and decided differences of opinion in many shops. Foremen were jealous of their former rights and power, *and argued that they could not maintain discipline without the club of dismissal to hang over a man's head.*

Then, too, they very naturally wanted to pick their own men.

On the other hand, advocates of the new plan hugged the delusion that the establishment of an employment department solved all the difficulties of the shop personnel. They desired and claimed the right to select men, to apportion them to such departments as their questioning indicated they were best fitted for and to take away all the power of the foreman regarding the hiring and firing.

And, as is almost always the case, neither side was entirely right nor all wrong.

Irresponsible Clerks

In too many cases the employment office has been turned over to inexperienced clerks who do not appreciate the responsibilities of their position and who

THE OLD-TIME FOREMAN WAS A CZAR IN HIS OWN SHOP

have become even more czar-like than the old time foreman.

There has, however, been much improvement along this line and we have developed some big men in the industries, who have done much to reduce the great, wasteful labor turn-over.

The general opinion seems to be that the foreman should not be burdened with the interviewing of applicants as they come for employment. His training in shop work makes his time more valuable in getting out production. In most cases, however, the foreman is called in to the final interview before a man is hired for his department. In one very successful plant the shop superintendent, the foreman and the employment

THEY COULD NOT MAINTAIN DISCIPLINE WITHOUT THE CLUB OF DISMISSAL TO HANG OVER A MAN'S HEAD

manager meet the applicant before a final decision is made. A neat room is provided and the man made to feel as much at ease as possible with the three interviewers mentioned.

Co-operation on All Sides

As with every other phase of shop life, good results can be secured by each trying to see the other man's point of view and by working together to secure the best results for the shop as a whole. A little care on all sides will obviate the resentment which sometimes arises from the feeling that one or the other is encroaching on the rights of authority which the position confers.

(Other articles on this subject will appear in later issues.)

Grinding and Lapping

By Frank C. Hudson

The making of definitions is perhaps one of the most difficult problems which confronts us. It is easy enough when one who reads what you have written already knows what you are talking about. He recognizes the definitions because he knows what is being described. But if he doesn't, it's another matter entirely. Recognizing the piece by the definition is a different story.

Try it on the simplest thing you know and then see how many other things can be fitted equally well to the same definition.

As a concrete case, what is the difference between grinding and lapping? Does it depend on the kind of work, the kind of abrasive, the way the abrasive is used or the speed of cutting? Or are there other factors which enter into the processes and what are they?

The Industrial Co-operative Course of the Lansing High School

A Course, Open to the Youths of the City of Lansing, Intended to Provide Thorough Training and Experience in Technical Trades

By E. M. HALL
Director of Vocational Education

TO PROVIDE for the youth who will eventually fill the non-commissioned offices in life, such as highly skilled tradesmen and foremen, many school customs were departed from in nineteen twelve when an industrial course for local high school boys was inaugurated in Lansing, Mich. It was patterned after a similar course then being tried out at Fitchburg, Mass. Due to the inherent characteristics of the work, it was established in a separate department of the school. Since its inception, similar courses have proved to be national needs.

The course is distinct from the Academic Course in that it is not a college preparatory course. A post-graduate course of one year is necessary for a graduate of the industrial course to make proper preparation for college entrance. It is distinct from the commercial course in that it does not aim to prepare the student for work in business offices or in mercantile establishments.

Qualifications for Enrollment

At present, any boys having the equivalent of an eighth-grade education may elect the course. Boys who have completed work in other courses may transfer to this without loss of ninth-grade credits, providing they have good reasons for the change. Provision is also made for those who have done work in the continuation school to apply it toward this course. An important consideration for those who have left school before they are eighteen, is that since they are required by the James law to spend four days a month at school they might better spend ten days a month in school on this regular high school course and get their trade thoroughly and at the same time get a high school diploma.

There are now one hundred twenty-five enrolled. Of course some of the students do not finish the four year course, but when circumstances prevent a student's continuance, arrangements can usually be made so that he can find big advantage from the work done on the course up to the time of leaving. The type of student is indicated by Figs. 1, 2 and 3, which show school views and by the headpiece which shows some of the students engaged in the study of electrical apparatus.

Work of the First Year

During the first semester the study of proper methods of organization and the duties and privileges of our democratic society is taken up in a very vital and interesting manner. Visits to the various civic sessions such as meetings of the council, the court and the state legislature result in plenty of first hand and up to date matters for discussion. Time is spent also in English and algebra, the required subjects in all high school courses. Both of these subjects are vitalized through special adaptation to the interests of the student. These boys proceed in the same manner as other freshmen, except that all take up the study of mechanical drawing instead of an elective subject. This study is of utmost importance, for it is to the mechanic what shorthand is to the office worker.

FIG. 1. SHOP MATHEMATICS

FIG. 2. MECHANICAL DRAWING

In the second semester industrial arithmetic replaces community civics. Guidance in the choice of a vocation is given through the agency of readings and trips to the various industries of the city. A systematic effort is made to assist each student in his choice of some trade which he would like to try out as soon as he has completed the semester of school work. The fundamentals of shop work are studied and methods of learning a trade are explained. While getting this prevocational work of the ninth grade, the student spends his full time in school. The following is an outline of the four year course:

OUTLINE OF THE FOUR-YEAR COURSE

First Year

First Semester	Second Semester
English 1 Composition	English 2 (Voc. Guidance)
Community Civics 1	Shop Mathematics 1
Algebra 1	Algebra 2
Mechanical Drawing 1	Mech. Drawing 2
Physical Education 1	School Shop
	Physical Education 2

Second Year (every other week in school building)

First Semester	Second Semester
Shop Work 1	Shop Work 2
English 3	English 4
Shop Mathematics 2	Shop Mathematics 3
Physics 1 (Mechanics)	Physics 2 (Mechanics)
Mech. Drawing 3	Mech. Drawing 4
Physical Education 3	Physical Education 4

Third Year (every other week in school building)

First Semester	Second Semester
Shop Work 3	Shop Work 4
English 5	English 6
Shop Mathematics 4	Shop Mathematics 5
Chemistry 1	Chemistry and First Aid 2
Physics 3 (Electricity)	Physics 4 (Electricity)
Drafting 5	Drafting 6

Fourth Year (every other week in school building)

First Semester	Second Semester
Shop Work 5	Shop Work 6
English 7	English 8
Physics 5 (Heat)	Physics 6 (Sound and Light)
Chemistry 3	Chemistry 4
Drafting 7 (Design)	Drafting 8 (Design)

VOCATIONS OPEN TO STUDENTS

Pattern making, automobile mechanics, mechanical drafting, sheet metal layout and construction, cost figuring, molding, woodworking, forging, toolmaking, tool design, general machine work, gas engine work, electrical work, house building, plumbing, steam-fitting and printing have been pursued thus far. Other occupations may be elected by students and given in case of no serious obstacle. Surveying, for instance can not be given well on this course at present because of its seasonal characteristics. Molding, printing and plumbing offer exceptional opportunities for such men as will graduate from this course and it is expected that more boys will elect one of these substantial trades. There are shown in Figs. 4 to 12 inclusive, nine views of students engaged in productive tasks at their respective shops.

As soon as the first year's work has been done the student enters upon his trade work as an apprentice. He is given a trial period, at the end of which (if he has shown evidence of future success in that line of work) arrangements are made for his continuance of it upon the part time basis, every other week being spent as an apprentice on real, profitable work in Lansing industries. If he fails in his trial, or dislikes that particular trade, he is encouraged to try another trade or to change to an academic or commercial course.

FEATURES OF THE PART-TIME WORK

During the three years as an apprentice, the student gets fair wages, gradually being increased in accordance with the interest and ability displayed. The wages, which are obtained from the beginning of the trial period, make it possible for the student to support or partly support himself while getting his high school education. One thing which counts greatly toward the attainment of the trade is the fact that the boys contine their trade work through the entire fifty-two weeks of the year except for two weeks of vacation in the summer and one week at Christmas time. Most of the boys have been greatly interested in their shop work and prefer less vacation, but all are supposed to take the two weeks. Sometimes the co-ordinator recommends an extended vacation for some good reason such as poor health. Every other week is spent by the student in school on subjects which are closely related to his trade, although enough general work is included to enable him to take his place as an American citizen when he steps out into the full responsibilities of life.

Subjects vary somewhat with the trade pursued; but in all technical trades a knowledge of the principles of the simple machines, mechanics of fluids, heat, sound, light, shop mathematics, letter writing, drafting, chemistry, metallurgy, electricity, first aid, and a good command of the English language are great factors toward promotion and pleasure.

Much of the school and shop work is interdependent. In order to maintain this relation and to adjust various matters which arise with the student in his shop and school work, a co-ordinator is engaged who visits the boys frequently while they are at their trade work in the industries. At present the director of vocational education acts in this capacity. Shop note books and technical reports are turned in periodically and are corrected in regard to proper English, sketches and facts. The weekly report shown in Fig. 13 is of great assistance to co-ordination.

Practical suggestions are given in many ways. Each student is regarded as an individual case and novel and varied methods of teaching proper relations and procedure while he is learning the trade are resorted to. Many little errors and opportunities for improvement are called to the attention of the student by the foremen and co-ordinator so that he may progress just as rapidly as his native ability and interest allow. Every student is taught how to use the periodicals devoted to his particular trade and is assisted in the study of some good instruction book on the shop phase of his trade. A recent movement has been made for each co-operating concern to appoint one of its men who has had some previous educational experience to take special interest in each of these apprentices and to assist the co-ordinator in behalf of these boys. The Reo Motor Car Co. employs former educators who go into great detail to perfect their embryo mechanics. In other concerns the manager himself gives detailed attention to this work.

For a final task in his school work in chemistry the student selects some important material which is used in his trade, makes a special study of it, including experiments and writes a theme in regard to it. A long

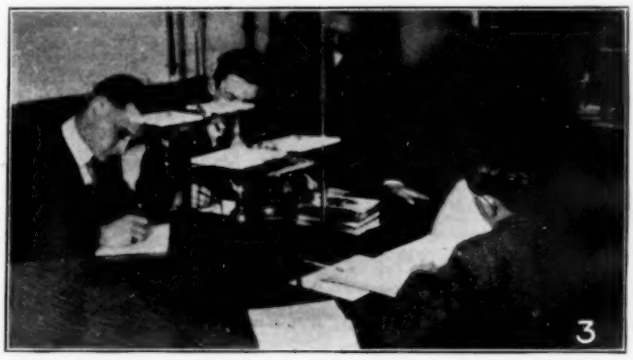


FIG. 3. PHYSICS LABORATORY

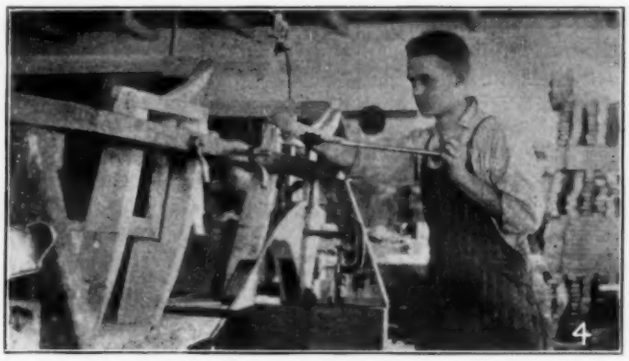


FIG. 4. AUTOMOBILE BODY-MAKING, AUTO BODY CO.

FIG. 5. ASSISTING THE FOREMAN, NOVO ENGINE CO. FIG. 6. GAS ENGINE ASSEMBLY, REO MOTOR CAR CO.
FIG. 7. STORAGE BATTERY REPAIR, LANSING BATTERY SHOP

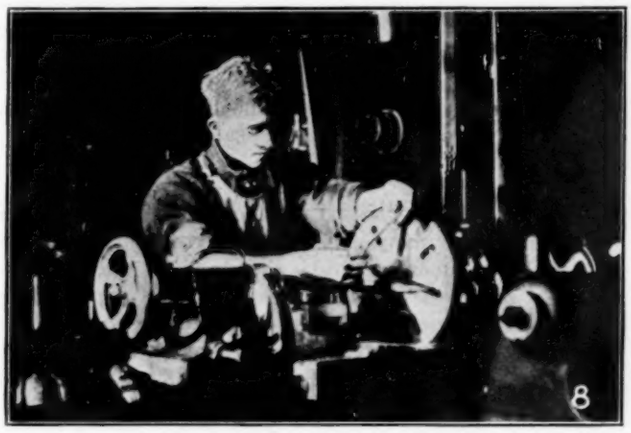


FIG. 8. TOOLMAKING, REO TRUCK CO.

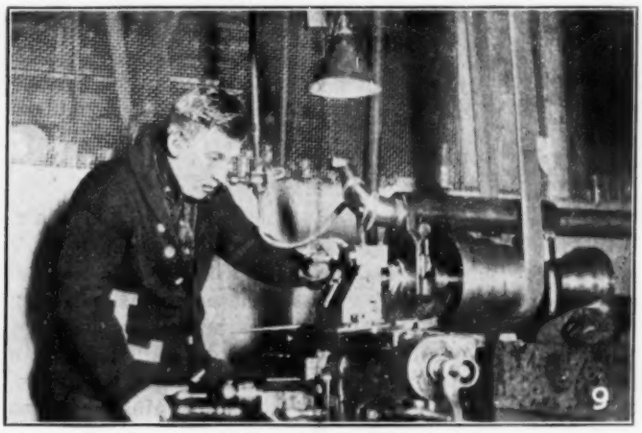


FIG. 9. TOOLMAKING, MICHIGAN SCREW CO.

FIG. 10. PATTERN MAKING, NOVO ENGINE CO.

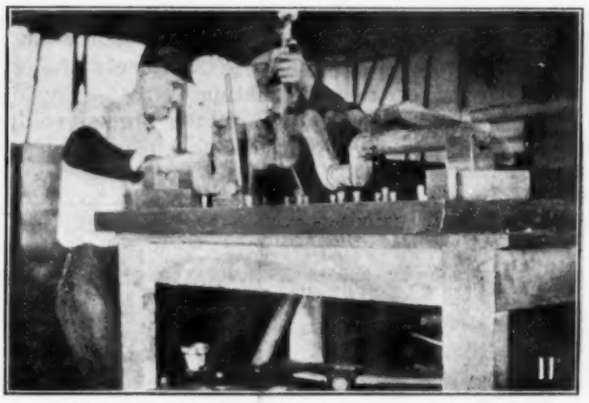


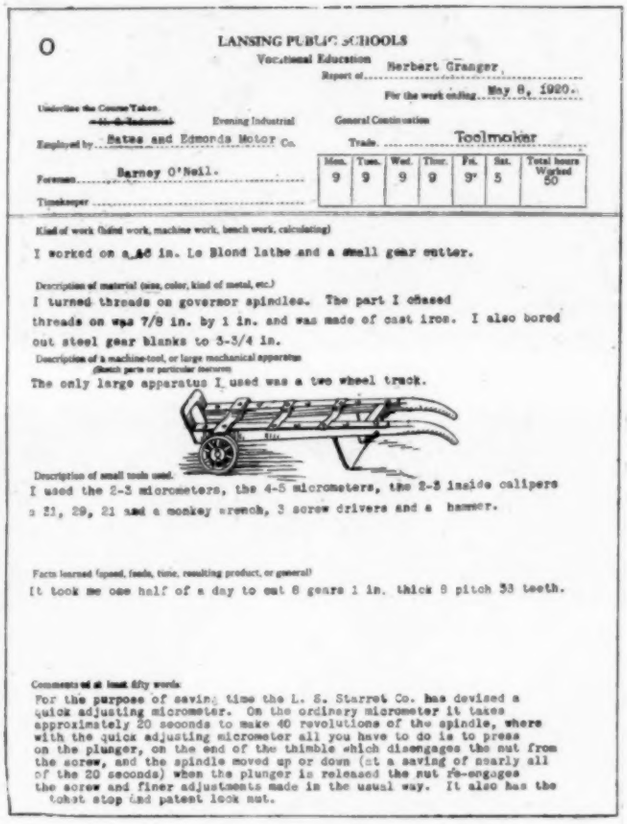
FIG. 11. INSPECTING FORGINGS, ATLAS DROP FORGE CO.

theme which relates the trials and triumphs of his four years of combined school and trade work closes the class work in English.

Beside a large number of social functions of the high school which interest many of the industrial course students the "Knights of Industry" caters especially to the social needs of the part-time students. Their evening meetings with debates, discussions and talks by local captains of industry help them to create lasting fellowships and proper habits. The annual picnic has come to be an institution. At one, the game of baseball between the "All Stars" and the "Boilermakers," with faculty members and students on each side, proved to be well worth while.

Concerning the moral guidance of the students taking this course, it may be said that not much can be done

FIG. 12. PATTERN MAKING, REO MOTOR CAR CO.



LANSING PUBLIC SCHOOLS
Vocational Education
Report of Herbert Granger
For the week ending May 8, 1920.

Underline the Course Taken.
~~All-Day Industrial~~ Evening Industrial General Continuation
Employed by Bates and Edmonds Motor Co. Trade Toolmaker
Foreman Barney O'Neil.
Timekeeper

Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Total hours Worked
9	9	9	9	9½	5	50

Kind of work (hand work, machine work, bench work, calculating)
I worked on a 16 in. Le Blond lathe and a small gear cutter.

Description of material (size, color, kind of metal, etc.)
I turned threads on governor spindles. The part I chased threads on was 7/8 in. by 1 in. and was made of cast iron. I also bored out steel gear blanks to 3-3/4 in.

Description of a machine-tool, or large mechanical apparatus (Sketch parts or particular features)
The only large apparatus I used was a two wheel truck.

Description of small tools used.
I used the 2-3 micrometers, the 4-5 micrometers, the 2-3 inside calipers a 21, 29, 21 and a monkey wrench, 3 screw drivers and a hammer.

Facts learned (speed, feeds, time, resulting product, or general)
It took me one half of a day to cut 8 gears 1 in. thick 8 pitch 38 teeth.

Comments of at least fifty words
For the purpose of saving time the L. S. Starrett Co. has devised a quick adjusting micrometer. On the ordinary micrometer it takes approximately 20 seconds to make 40 revolutions of the spindle, where with the quick adjusting micrometer all you have to do is to press on the plunger, on the end of the thimble which disengages the nut from the screw, and the spindle moved up or down (at a saving of nearly all of the 20 seconds) when the plunger is released the nut re-engages the screw and finer adjustments made in the usual way. It also has the ~~chest~~ stop and patent lock nut.

FIG. 13. WEEKLY REPORT OF STUDENT

for one with very little moral stamina. However, the boys who have had an average home training will see that in order to keep proper standings both in their school and shop work, they must select that which is good in life and shun the evil things. The contact which they get with all sorts of people will strengthen, rather than weaken their characters by early cultivation of the habit of overthrowing temptations.

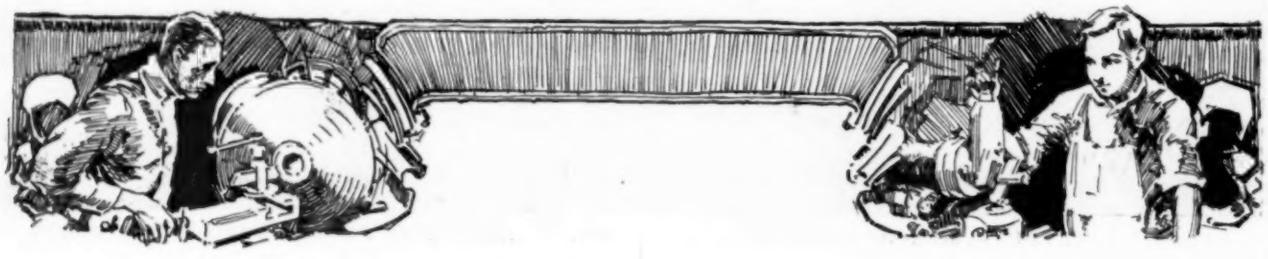
EQUIPMENT

In 1918 many of the old handicaps were removed. Well appointed classrooms are now provided. Chemistry and physics laboratories which allow each individual to experiment, are at hand. The mechanical drafting room is perfectly lighted even in dull weather. Its equipment is sufficient for all sorts and grades of classes in architectural, sheet metal and machine part drafting. The machine shop is in readiness for teaching blueprint reading, lay out work and bench work. Recently twenty-two machine tools have been added. There are lathes, milling machines, grinding machines and drilling machines. Provisions have been made in the electrical laboratory for the study of a great variety of electrical apparatus, repair and installation.

Of course pride is taken on the special equipment needed and provided in the school plant, but in this regard it may be said that one of the excellent characteristics of this part-time course is that the equipment used by the upper classes for *learning* their trades is identical with that which will be used when they *ply* their trades. On alternate weeks they find themselves with more ideal equipment and in more real surroundings than could be placed in a school building even with thousands of dollars at the disposal of the head of the department.

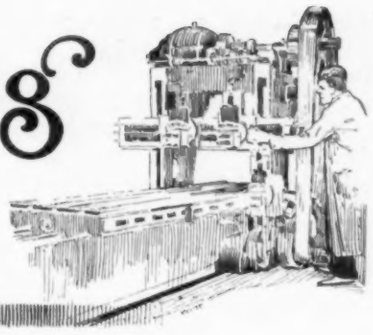
REQUIREMENTS OF THE SMITH-HUGHES LAW FULFILLED

Although not many cities were giving such a course in 1918, it is somewhat gratifying to know that Lansing was one of three cities to have its work approved by the state authorities. Detroit and Muskegon were the other two. Such approval not only stamped the work as successful but brought a fund of $1,884 which was a reimbursement on the salaries of teachers in this department. Had Lansing refrained from accepting the Smith-Hughes and Tufts legislation, that is, had not provided properly organized industrial courses, this money would have gone to other localities without reducing our taxes in the least, since one-half of it was from the national treasury and one-fourth was from the state treasury. The work has been approved each year since the Smith-Hughes law.



Metal Cutting Tools

By A. L. DeLeeuw



II. Consideration of the Element of Feed—Analysis of the Round-Nosed Tool—Effect of Fundamentals of Cutting Action on Design

IN THE foregoing pages it was supposed that the work was stationary, and the tool moving in one direction only; namely, in the direction in which the cutting took place. As we have seen, this condition actually exists in the plate planer. In practically all other applications of metal cutting tools the relation of work and tool is not quite so simple; the element of feed must be considered. The feed may take place either during the cut or after the cut. This latter condition we find in planers, shapers, slotters, Fellows gear shapers, etc., whereas the former condition exists in lathes, boring machines, drilling machines, etc. There is finally a third case which differs slightly from these two cases; namely, the milling machine. In a planer or slotter either the work or the tool makes a stroke, after which some movement is made by which the relative position of tool and work is altered. In the boring machine or lathe this change of position of tool in relation to the work takes place while the cut is on. The condition peculiar to the milling machine is this: That the feed takes place in the same direction as the cut, that it is continuous as in the lathe, and yet to a certain extent is also intermittent as in the planer.

When the Work Is Wider Than the Cut

If the work is wider than the cut, then a condition prevails, as shown in Fig. 22, where the shaded sections indicate the successive cuts taken. The tool would remove section 1 moving in a straight line, then return, then move to the left the width of one cut, then take another cut under exactly the same conditions as the first one, etc. It will be seen that cutting action takes place at the bottom and at the left side of the tool. If the cutting took place at the bottom only the chip would curl upward, if on the left side only the chip would curl to the right. A particle of metal close to point *A* would have a tendency to move both upward and to the right. It will readily be seen, then, that the chip must be deformed, and that the particles separated close to the point *A* must exert a pressure on the rest of the chip so as to cause this deformation and, therefore, that the part of the tool close to point *A* is subjected to additional pressure or strain besides that caused by the removal of the chip. It will also be seen that even if there were no additional pressure at the point *A*, yet the fact that heat is developed near the point *A*, both at the bottom and at the left, will cause this point to receive more heat than any other point of the tool. Besides the section of metal through which this heat can be carried off is small and in addition the heat would have to be carried off, at least partly, by other sections of the tool which themselves are heated. This point *A* of the tool then removes more metal, does it under heavier pressure, and is in a less favorable condition for dissipating the heat than any other point of the tool, and we may expect that this point will break down first under the pressure and heat developed. This we find to be actually the case in practice, and for this reason it is customary to make tools with a rounding contour, where bottom and side join. Even when constructed this way there still remains the condition that the bottom chip crowds the side chip and vice versa. This cannot entirely be avoided. But if a tool were constructed as shown in Fig. 23, the amount of crowding would be very small and the area over which the pressure could be distributed and by which the heat could be dissipated would be quite large, so that such a tool might be expected to stand up well under heavy service. As a matter of fact it does.

Advantage of Round-Nosed Tool

However, another element enters in here which makes it less advisable to use a tool of this description. In the previous article mention was made of the fluctuating pressure of the tool when making a chip. This condition was observed in a series of tests made by Dr. Nicolson, and a diagram showing these fluctuations may be found on Folder 12 of "On the Art of Cutting Metals" by F. W. Taylor. Mr. Taylor points out how these fluctuations have a fixed period of time under a given set of conditions (such as nature of metal to be cut, depth of cut, form of tool). If this period synchronizes with the natural period of vibration of tool or work of some part of the machine, then the vibrations may be much magnified and cause what is known as "chatter." Such a condition of synchronism is avoided by constructing the tool in such a manner that the chip is broken up in different ways at the different points of the cutting edge. It is partly for this reason that he recommends his round-nosed tools.

The Broad-Nosed Tool

Mr. Taylor also calls attention to the fact that what he calls the broad-nosed tool, a tool more along the general lines of Fig. 23, would probably be somewhat more efficient and have some other advantages; but he considers these advantages of minor importance because in constructing his round-nosed tools he aimed for a general utility tool for roughing work and he was willing to sacrifice some of the smaller advantages to be obtained for the sake of standardizing the tool; in other words, he aimed at a tool which might successfully be used under a great number of varying condi-

tions. As such the round-nosed tool is very successful. In late years conditions in machine shops have changed materially from those that existed at the time Mr. Taylor conducted his experiments. In those days most lathe work was done on the engine lathe and with standard tools. At the present time the great majority of lathe work is done on specialized machines

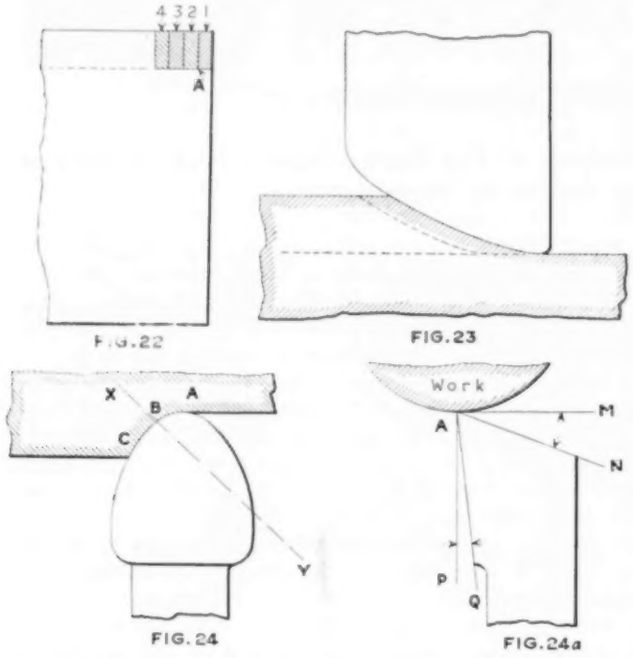


FIG. 22 FIG. 23 FIG. 24 FIG. 24a

FIG. 22. SUCCESSIVE CUTS INDICATED. FIG. 23. BROAD-NOSED TOOL. FIG. 24. RAKE AND CLEARANCE

and with special tools. For this reason the writer believes that it is necessary to look into the fundamentals of the action of cutting tools so as to enable the tool-setter, the toolmaker and the tool designer to select the kind and form of tool specifically adapted to the work he has before him. In other words, though agreeing fully with the conclusions reached at that time by Mr. Taylor, the writer believes that the round-nose tool is only one of the many kinds of tools to be used under modern conditions.

Rake and Clearance

In the following pages frequent use will be made of the terms *rake, front clearance* and *side clearance.* In order to give definitions which can be easily remembered we will suppose a tool clamped in the toolrest of a lathe so that the extreme tool point touches the finished part of work at exactly the height of the center.

Under those conditions, we give the following definitions:

Rake will always be given for a single point of the cutting edge.

Note: If Fig. 24 is the top view of a tool, the points *A, B* and *C* may each have a different rake.

Rake is measured in a vertical plane going through the point for which the rake is to be determined.

Note: Fig. 24a shows a vertical section of the tool through the point *A* and at right angles to the work.

Rake is the angle measured in the vertical plane at right angles to the work between a horizontal line and the top of the tool.

Note: If the rake were to be measured for point *B*, we would have made the vertical section *XY* and proceeded as before.

Clearance is the angle measured in the vertical plane at right angles to the work between a vertical line and the edge of the tool.

Note: In Fig. 24a the angle *PAQ* would be the rake and the angle *MAN* would be the clearance.

Front clearance is the clearance between the tool and the finished part of the work.

Side clearance is the clearance between the tool and the work measured in a vertical plane parallel to the feed motion of the tool.

Note: There is no really good reason why a distinction should be made between front and side clearance except that it indicates in a general way about which part of the tool we are speaking.

The above definitions are somewhat different from the ordinary conception of rake and clearance but they fit in with the way we should look at the action of the tool.

The angle *NAQ* in Fig. 24a is the angle of the tool and in the future we will call it the contained angle. As far as the cutting is concerned this angle is of no importance. If, for instance, the clearance angle were very large but the material of which the tool is made were of such a nature that the tool would not crumble or break down, then all conditions of cutting would be exactly the same as if this angle *MAN* were very small. However, a change in the rake angle *PAQ* will change the cutting conditions very materially. Again we may look at it this way: If we leave clearance and rake angles as they are ground on the tool the same, but take the tool and turn it in a vertical plane around the point *A*, we will get an entirely new tool, though the contained angle has not changed. We will get a tool which may cut better, because its rake angle in relation to the work (its true rake angle) has been increased, or we might get a tool which wears away very quickly because its clearance angle is too small.

The Contained Angle

The contained angle is of interest when we look at the lasting qualities of the tool but not when we look at its cutting qualities. A razor blade, for instance, would have splendid cutting qualities but no lasting qualities. A tool of which the contained angle closely approaches a right angle might have good lasting qualities but would have poor cutting qualities. A large contained angle makes a strong tool and a tool which readily caries off the heat.

Rake angle is something of which we should have *as much* as we dare to use; clearance angle is something of which we should have *as little* as we can get along with. The contained angle should be as large as possible.

Here again is a contradiction, for we cannot make both rake angle and contained angle as large as possible at the same time, and it will be up to the tool designer to compromise between these two contradictory requirements.

Dr. Nicolson found that there was a certain rake angle above which it was not profitable to go, and Mr. Taylor, investigating this condition, found very much the same thing. However, both investigations confined themselves to roughing cuts only. Under these condi-

tions the amount of power required for a given cut or the pressure on the tool were of minor importance, whereas the speed at which the tool could be run for a given cut and the length of time a tool could be used before resharpening were of major importance. There are, however, cases where considerations of an entirely different nature come to the foreground. Our chief consideration might be a smooth finish, or absence of spring in the work, or great accuracy of diameter; and if such points are of main importance then we should look at those qualities of the tool which produce these results.

Grinding the Round-Nosed Tool

Referring back to the tendency of a broad-nosed tool to cause chatter, we must recall to mind the previous chapter in which attention was directed to the effect of a change of rake angle on the shape of the chip. We found that the tool will penetrate further before a chip splits off. In other words, the fluctuation of pressure occurs with a longer period with a greater rake angle than with a lesser one. A round-nosed tool might be ground in various ways; for instance, as indicated in Figs. 25a or 25b or 25c. In each case the light lines represent the low part of the ground surface. Whichever way the tool is ground there will be a difference in the amount of rake in the points *A*, *B* and *C* and, as a consequence, the period of pressure fluctuations will also be different at these three points. For this reason a round-nosed tool is particularly desirable when a heavy and deep cut has to be taken for roughing purposes.

In Fig. 25c, arrows are drawn at various points of the tool and at right angles to the edge of the tool at that point. It will be seen that all points to the left of point *A* can be used as cutting points because they are higher than any other point of the tool further along the arrows; in other words, they have rake. But the condition is different with the point to the right of Point *A*. Point B_1 is so located that its arrow is parallel to the grinding lines. Any point between *A* and B_1 will still have some rake, but very little. All other points from B_1 on, such as C_1 and D_1, would have negative rake; that is, these points would be lower than other points further down the arrow. A tool of this description, therefore, can be used for one direction only. A tool ground like Fig. 25a can be used for right- and left-hand cutting, but the rake becomes very small as soon as we go some distance away from the center line. In other words, such a tool is not suitable for deep cuts. A tool ground like Fig. 25b would have its best rake far away from the center line; it could be used on one side only and, even then, it would have no rake at all right at the center so that it would be necessary to set the tool at an angle with the work as shown.

Various Types of Planer Tools

Planer tools can be divided into two classes—roughing tools and finishing tools. This does not mean that a roughing tool can never be used for finishing or vice versa, but that each class has those qualities which make it particularly adapted to its particular duty. The qualities for roughing are:

1.—A sufficiently large contained angle to stand the pressure and carry off the heat.
2.—Absence of sharp corners.
3.—A heavy shank to permit of the unavoidable bending of the tool without bad results.
4.—Made of material which has great strength and can attain a high temperature without losing its hardness.

Qualities Which Finishing Tools Should Possess

Finishing tools, on the other hand, should possess the following qualities:

1.—They should be made of a material which will permit them to retain a keen edge for a long time.
2.—They should have a shape so as to minimize the depth of the tool mark left on the work.
3.—If necessary, they should have sharp points to enable them to square up work.
4.—For some purposes they should be so constructed as to permit a certain amount of bending.

The main varieties of roughing tools are the round-nosed tool, the diamond-point tool, the square-nosed tool and the cut-off tool. For roughing plane surfaces such as the tops of beds, tables, large pads, etc., the round-nosed tool is to be recommended. The figures given for the various angles of such tools by Mr. Taylor can safely be followed, but the clearance is somewhat larger than is absolutely needed, due to the fact that a planer tool does not need to penetrate under the action of the feed. It is subject to the feed motion only while it is out of the cut, and not, as the lathe tool, when it is in the cut.

Whether a horizontal surface is planed up by a tool in the cross-rail head or a vertical surface by a tool in the side head does not affect the shape of the tool.

Necessity of Strong Shank or Toolholder

Too much emphasis cannot be placed on the necessity of having a very strong, heavy tool shank or, where toolbits are used, a very substantial toolholder. If the shank or holder is flexible, then the tool will bend under the pressure of the cut, causing the tool point to dig deeper into the work. We have seen that for the ideal functioning of the tool absolute rigidity is required, so that the bending of the tool will bring us further

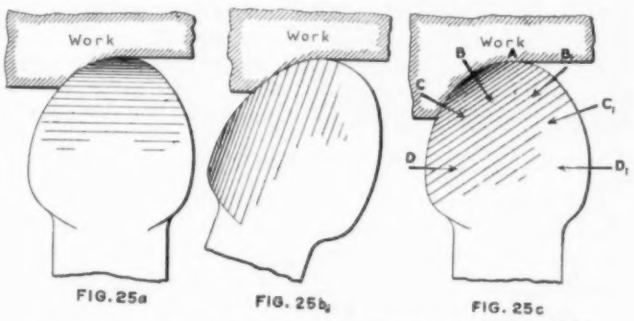


FIG. 25. WAYS OF GRINDING ROUND-NOSED TOOL

and further away from ideal conditions. Practical results of this digging-in are that the tool will follow all the fluctuations of the depth of the cut, so that it will actually not merely assume a new position but it will be jumping in and out with every little variation of depth or hardness of the metal. This jumping action brings sudden, heavy strain to bear on the tool edge and destroys it rapidly.

In planing it is often unavoidable to have a great overhang of the tool, but wherever possible the overhang should be made as short as conditions will permit.

Given a choice between the best imaginable toolholder or a solid tool of equal section, the solid tool has some advantages because its overhang can be made less. Given, on the other hand, conditions which require

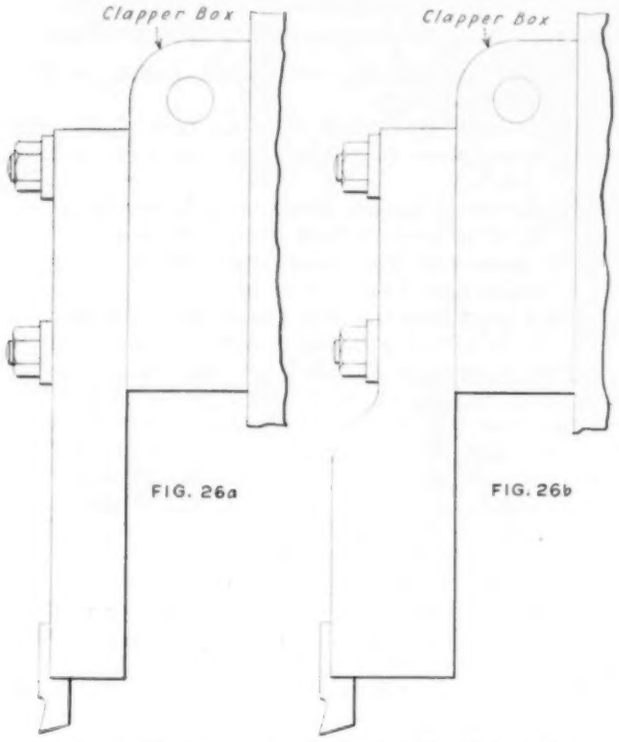


FIG. 26. TWO FORMS OF PLANER TOOLHOLDERS

a great overhang, and it will be better to use a toolholder than a solid tool, for the toolholder can be made as heavy as desired, whereas the size of tool is limited by the high cost of tool steel, especially if high-speed steel is used. With long overhang the tool designer is often limited as to size of toolholder by the dimensions of the clapper box and the distance between the clamping bolts, or the length of these bolts. He reasons, probably unconsciously, that it is of no use to make the toolbar 4 in. square when he can get only 3 in. under the clamps, but this reasoning is not entirely correct. A toolholder bends over its entire length when under pressure, and by making part of it heavy, the total amount of deflection will be reduced. (See Figs. 26a and 26b.)

THE DIAMOND-POINT TOOL

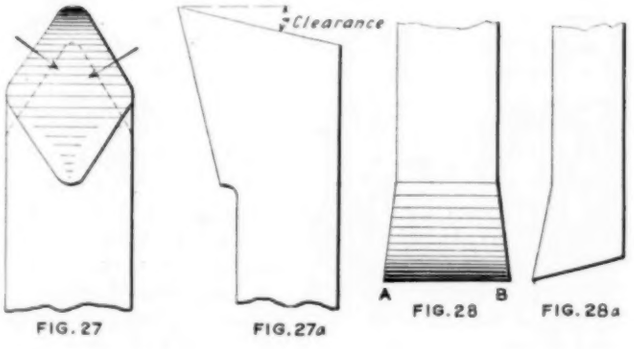
The diamond-point tool is illustrated in Fig. 27, and the way of grinding the rake is indicated in our conventional manner. Looking at the arrows, it will be seen that there is rake in all directions and that the tool can be used as right- or left-hand tool. Besides, it is very simple to produce this rake. It is not quite so simple to grind the clearance, which is indicated in dotted line and also in Fig. 27a. This tool is very useful for relatively light roughing cuts, but cannot be used for the very heaviest cuts. It used to be the one style of tool which every machinist would use for planer as well as lathe work. It is doubtful whether there is any tool which has quite such an all-round usefulness.

For jobbing shops and for single jobs in a machine shop or toolroom this tool is just as useful as ever, but for regular production and for heavy cuts the round-nosed tool should be used.

The square-nosed tool illustrated in Fig. 28 and 28a is often used wrongly when a round-nosed tool might be employed to better advantage. Its chief use is for roughing out where the cut ends against a shoulder and must be squared later on, as in Fig. 29, in which the metal to be removed is shown in section. It is also quite properly used for planing slots as in Fig. 30. Taking a cut such as shown in Fig. 30, there is front rake only, and no side rake, which is liable to produce a rough cut unless a very fine feed is used. As a rule the corners *A* and *B* of the tool are sharp. (See Fig. 28). This also reduces the amount of feed which it is possible to take with such a tool. On the other hand, rounding the corners would aggravate the effects of lack of side rake. For heavy cuts the tool should be ground as shown in Fig. 31, which requires a double setting for the grinding and is not easily accomplished. By splitting the tool in two, in other words, by using two tools side by side and properly clamped together, this difficulty can be overcome. (See Fig. 32.)

The cut-off tool has the same requirements as the square-nosed tool. As a matter of fact, it is merely a square-nosed tool of less width.

While on the subject of roughing tools the multiple tool should be mentioned. The multiple tool consists of a number of toolbits so placed in a holder that one after the other enters the planing cut. The first one takes a cut the full depth and with one-fourth of the amount of feed—that is, if there are four tools in the holder. The next tool enters a little bit later and again takes the same amount of feed, and so forth. A single, heavy tool might take the entire amount of feed, and the only reason why multiple tools are used is the fact that such a heavy feed with a single tool would cause the metal to break out at the end of the stroke. Where such heavy planing cuts regularly recur it is better to use a single tool and guard against the breaking-out of the metal in some way; for instance, by casting the piece with a bevel edge where the tool is



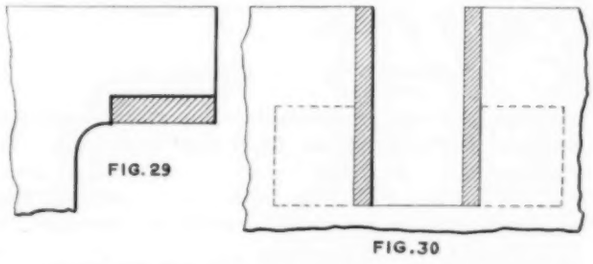


FIG. 27. DIAMOND-POINT TOOL. FIG. 28. SQUARE-NOSED TOOL. FIG. 29. CORRECT PLACE FOR USING SQUARE-NOSED TOOL. FIG. 30. SLOT PLANING WITH SQUARE-NOSED TOOL

to run out. The advantages of the multiple tool are that a wide feed can be taken, even where no provision is made against the breaking-out of the edge, and that this can be done without the expenditures for heavy, high-speed tools. The disadvantages are that such a tool requires four bits which should be carefully ground and set, and that for every variation in the feed a new tool setting is required so as to divide the tool feed as evenly as possible among the cutters. Fig. 37 shows the principle of the multiple tool and the way it is arranged to provide for quick adjustment for varying feeds. The holder proper is made to swivel on the shank, and has four openings with the necessary clamping screws for the toolbits.

There are a great many varieties of finishing tools used for a planer. The most important, perhaps, from the standpoint of frequent use, is the square-nosed tool. This tool is often made without lip. There is no good

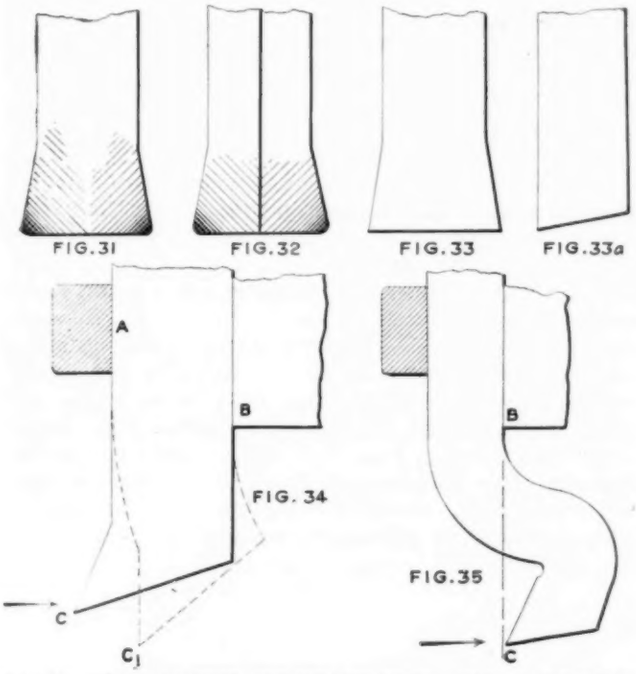


FIG. 31. TOOL GROUND FOR HEAVY CUTS. FIG. 32. DOUBLE TOOL. FIG. 33. FINISHING TOOL. FIG. 34. BENDING ACTION IN STRAIGHT-SHANK TOOL. FIG. 35. TOOL FOR WIDE FINISHING CUTS

reason why this should be so. The absence of rake merely increases the pressure and causes more spring. Such a tool will do fairly good work on cast iron but is not at all permissible on steel work. The proper way to construct this tool is to make it like the roughing tool. (See Fig. 33.) One of the reasons which might be given for the absence of rake is that the tendency to dig into the metal on account of spring is greater with than without rake, and this leads us to a close study of the spring of tools and its effect.

In Fig. 34 the tool is clamped at *A* and supported against the clapper box as far down as *B*, but from there on it is free and overhanging. The pressure being against the point *C*, the tool will bend with the point *B* as center. The position after bending is shown in dotted lines, very much exaggerated of course. As the point *B* lies back of *C*, *C* will be further down after bending, thus causing the tool to dig deeper in the work, increase the pressure, increase the bending, make it dig in still deeper, and so forth, until an equilibrium has been reached. If the metal to be cut is of a brittle nature, such as cast iron, the chip will jump away from the tool so that there will be even more fluctuation in pressure on the tool point than when the metal is tough, such as steel. When the chip flies away the tool point

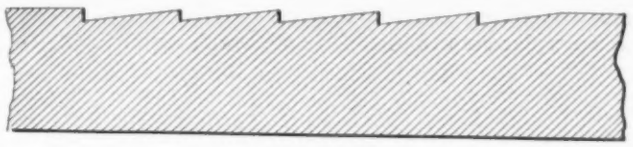


FIG. 36. EFFECT OF HAVING TOOL NOT SET SQUARELY

jumps forward, is caught against the uncut metal, pressed down again, and keeps on repeating this performance, causing chatter. This is particularly noticeable when an attempt is made to take a wide cut. As a rule the width of the cut is less than the width of the tool; for instance, when finishing cast iron a tool $1\frac{1}{4}$ in. wide might be used, taking a cut $\frac{1}{16}$ in. wide. The resistance of the tool against bending is directly proportional to its width. If now we should attempt to take a cut $\frac{2}{16}$ in. wide with this same tool the pressure will be twice as great and therefore the deflection will also be twice as great, and the increase in depth to which the tool is made to penetrate, due to this deflection, will be twice as great, or rather to be correct, more than twice as great. Should we attempt to take a cut $\frac{3}{16}$ in. wide, the deflection, and consequently the extra penetration, will be three times as great. It has

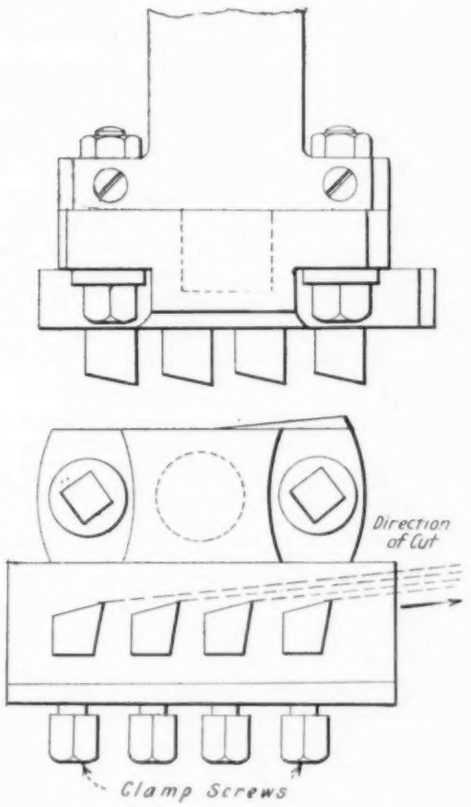
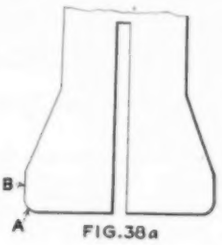


FIG. 37. MULTIPLE TOOL

been found extremely difficult to take wide finishing cuts with this style tool, and if such wide cuts are to be taken a tool should be used as shown in Fig. 35. Such a tool is called a spring tool. The cutting point *C* lies back of the extension of the back line of

the shank of the tool. If such a tool is under pressure, the point *C* will again move with *B* as center and, as a result, will be moved backward and slightly—very slightly—upward. When the chip jumps off, the tool will have a tendency to spring forward but will immediately be steadied by the increased amount of metal it finds. Spring tools are capable of taking very much wider cuts than the simple broad-nosed tool. The



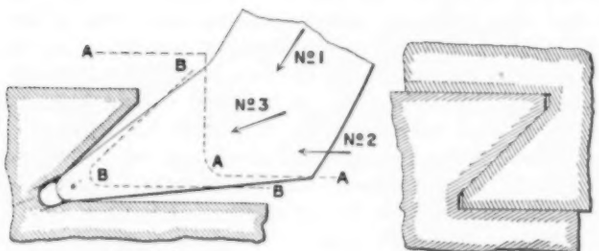


FIG. 38. TOOL FOR FINISHING SIDES OF SLOT. FIG. 39. DIFFERENT DESIGNS FOR SLIDE-WAY CROSS-SECTIONS

writer has seen cast-iron chips 12 in. wide and rolled up tightly taken by a spring tool.

Cast-iron surfaces are often scraped after having been planed, and it is advantageous to reduce the amount to be scraped off to a minimum. If the casting warps or springs the amount to be scraped off will naturally be more than desirable, but these are conditions which are not influenced by the tool. If, on the other hand, the tool is not set absolutely square with the work, the finished surface will appear as in Fig. 36. This also causes an unnecessarily large amount of scraping. To avoid this the tool should be perfectly straight at its cutting edge and should be set straight with the work. To obtain this the following is recommended:

Tool Grinding

The tool should be ground on a surface grinder instead of on a tool grinder, the edge should be stoned, and the tool should be set to a hardened setting piece clamped to the table of the planer and not to the rough or semi-rough surface of the work to be finished. Further, in order to produce a close-grained surface this tool should have very little clearance, from 2½ to 3 deg. This will have more or less of a burnishing effect which will close up the pores and reduce the amount of loose metal to be scraped off. The writer has seen the maximum finishing feed increased from ⅛ to 1 in. with a simultaneous reduction of the time required for scraping off the loose metal to one-third of the original time by following this method.

When the square-nosed tool is used for finishing slots, that is, when the sides only are used, it is not so necessary to have side rake. On the other hand, it becomes important to make the tool accurately to a given size so as to be able to plane two sides of the slot at a time. As a rule such a tool is constructed with sharp corners, but in the majority of cases it would be permissible to make the corners slightly rounded which is much better if it is important to maintain size.

In Fig. 38 such a tool is shown slotted in and with a small taper screw for holding the two sides apart and to the proper size. This Fig. 38 also shows the tool with sharp corners. A better construction would be to make the corners as shown on the enlarged view, Fig. 38a, where a round is shown at *A* and a small flat at *B*. The finish produced by this tool will be better and it will be possible to take a much wider feed with the same degree of accuracy.

In many cases three cuts are taken—a roughing cut, a semi-finishing cut and a finishing cut. In most cases the roughing tools can be used for the semi-finishing cut; but where shoulders must be produced a finishing tool will have to be used for the second cut. Generally speaking, it would be possible to get the advantages of the use of roughing tools for the second cut by the following method:

In Fig. 39 a slide-way is shown which must be finished. Due to the fact that the included angle is only 45 deg., a very delicate finishing tool must be used with a very sharp point. This requires a very light feed, for two reasons: To save the tool, and to avoid the sharp ridges which would be made in the work if a coarse feed were employed. The line *AAA* shows the outline of the rough casting. The line *BBB* shows the outline after roughing. If now we use a tool as shown for the second finishing cut, a round corner will be left where a sharp corner should be. However, this sharp corner is not desirable; it would be better to have the corner as shown in Fig. 39a and in any good design the mating piece for this slide-way will have its corner cut off as shown in Fig. 39a. Referring back again to Fig. 39, the semi-finishing tool has moved in the direction of arrow No. 1 for the bevel side, and in the direction of arrow No. 2 for the flat side. If now we had moved the tool by hand and for

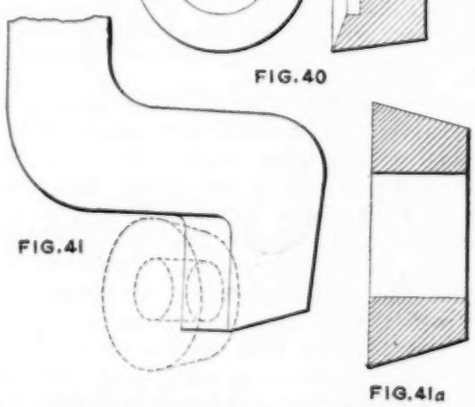


FIG. 40. BUTTON TOOL. FIG. 41. CORRECT MOUNTING OF BUTTON TOOL

a short distance in the direction of arrow No. 3, the piece after the second cut would appear as shown in Fig. 39b, and this section will permit the use of a finishing tool of more rugged construction and without delicate points. Besides, the planer hand saves the trouble of matching two surfaces. Designers of parts

that have to be planed with shoulders should give this matter careful thought. This method will permit the use of better tools, save much time, make a smoother finish and, due to the round corner, will make a stronger casting in the end.

Form Tools

Form tools are not much used on planers, but they are used to quite some extent on the shaper and the slotter. A case in point is the Fellows gear shaper which, as far as its mechanical action goes, is essentially a slotter. Among the form tools used quite frequently on the planer may be mentioned the rounding tool, the fillet-cutting tool and the button tool. The rounding tool is used for such light service and the round corner to be made requires, generally speaking, so little accuracy that it is not necessary to take any special precautions; but when the round is of large radius and it is necessary to make it with some degree of accuracy some little thought should be given to this tool. Under those conditions the rounding tool and the fillet-cutting tool become crude forming tools and should be treated as such. For a further treatment of form tools in general, the reader is referred to a later chapter.

The Button Tool

The button tool is shown in Fig. 40 and is, in a way, related to form tools. However, it is different from form tools in this respect: Form tools are so constructed that they maintain their shape after grinding, whereas a button tool does not. Button tools are often used for making fillets, where accurate size is not essential. They cannot be used for small fillets, but are very handy tools for larger ones. A few sizes should be kept in stock in the toolroom. Button tools can easily be ground on the circular grinding machine, though grinding of course reduces the radius of the fillet which it will make. As a rule button tools are screwed on the front of a straight bar or holder. It would be better to mount them as shown in Fig. 41

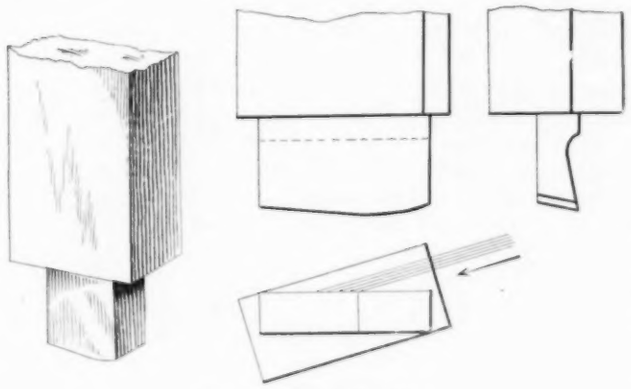


FIG. 42. SHEAR TOOL

where the holder is shown in full lines and the button tool in dotted lines. As will be seen, the holder is finished somewhat like a spring tool, having that part which receives the tool twisted in relation to the shank so as to give the tool both front and side rake. With such a holder the button tool itself can be constructed as in Fig. 41a. If it is desirable to use the button for right- and left-hand cutting in one setting, then a tool as shown in Fig. 40 should be used, and the toolholder should not have the twist or angle shown in Fig. 41, but should still be constructed on the lines of the spring finishing tool.

Shear Tools

A special chapter will be devoted to shear tools and to a more complete study of their action, construction, advantages and disadvantages. The planer is about the only machine tool on which a shear tool is occasionally used at the present time, and for this reason its general construction will be mentioned here.

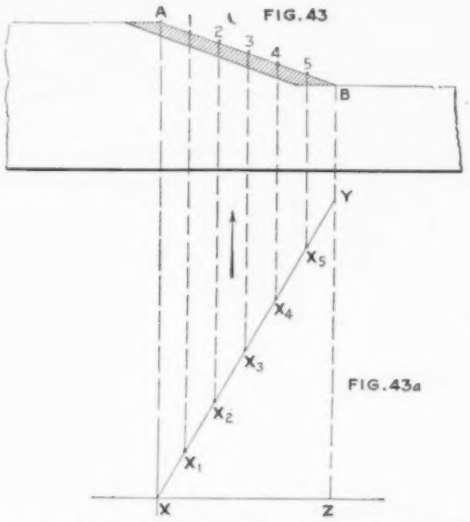


FIG. 43. CUT TAKEN BY PLANER SHEAR TOOL

It is used where a high-grade finish is required on steel and it meets this requirement admirably. Fig. 42 shows a shear tool arranged to feed toward the left. It will be seen that it is not possible to finish up to a shoulder with such a tool, and this is one of the chief disadvantages of all shear tools. The cut taken by a planer shear tool seldom exceeds $\frac{1}{8}$ in. in depth. Fig. 43 shows the cut taken by the tool very much enlarged. The workable distance from *A* to *B* is probably not more than $\frac{1}{8}$ in. The points *A* and *B*, as well as a number of intermediate points, are projected in Fig. 43a, and are marked *1*, *2*, *3*, *4* and *5*. The tool has cut out the point *A* at *X* (see Fig. 43a), the point *1* at *X1*, the point *2* at *X2*, the point *3* at *X3*, the point *4* at *X4*, the point *5* at *X5* and the point *B* at *Y*. Constructing the tool from this diagram we see that the lowest point of the tool—the point *Y*—must be the distance *YZ* ahead of the highest cutting point—*X*—of the tool. This distance *YZ* is, in a properly constructed shear tool, very large as compared to *XZ*, so that though the rake of the tool may be quite moderate, the effect is the same as if the rake were very large, or, in other words, as if the contained angle were very small. (For a more complete discussion of this feature see the chapter on Shear Tools.) This results in a much gentler action of the tool due to the fact that the small sections of chip are not completely split off but only slightly moved one over the other, and this in its turn causes a smoother surface of the work. The surface made by a shear tool has more the appearance of a polished surface and does not show the torn-out fibers common on steel which is finished by a square-nosed tool. A planer shear tool is not very well adapted for finishing cast iron as the fine edge is readily destroyed by the gritty material and this fine edge is absolutely essential for a nice finish. This matter will also be discussed more in detail later on.

Correspondence Supervision

By JOHN T. BARTLETT

Importance of Psychology in Business Letters—Women as Business Letter Writers—Duties of the Correspondence Supervisor

WHAT can we do about Jim Benedict who knows the Triangle line inside and out and is the logical man to handle complaints and requests for adjustment or repairs? Technically, Jim is the one man to handle such situations—but his letters! Last week we got that hot letter from Blink & Blink because Jim bluntly, without tact or courtesy, had refused an adjustment. Is Jim losing customers for us right along because he lacks ability to handle adjustments by letter?

S. L. Betts, head of the machinery department, has the idea he can take the brightest and best of the girl stenographers and make correspondents of them. He is trying the experiment with Elsie Snowden—nice girl, mighty good stenographer, been with us years. She seems to get along rather slowly, though. Somehow doesn't seem to grasp a letter problem; always says something that spills the beans. Betts is strong for his new idea. Is there anything in it? Does Elsie simply lack training, or are we wasting effort on a blind trail?

"Psychology" and "Costs"

What's all this talk about "psychology" in business letters? Is it something we ought to have or have we got it already? Of course business letters have definite and sometimes very important things to do. Are our letters doing them as well as they should?

How about our correspondence costs? Are we spending too much on our letters or would it pay us to spend more?

Does Edwin Climmer, sales manager, answer inquiries as well as he should? Ed is a fluent talker. He can write a three-page single-spaced reply without losing his breath once. He prides himself on his letters. But we wonder sometimes. He muffed that Debblebit export contract. We read the letter he wrote those people. It struck us as inadequate, but Ed was cocksure.

Such questions as I have put down above arise not alone in the isolated manufacturing organization, nor are they confined to any particular line. They are universal. They are questions with you and with your competitor. And more often than not, heretofore, the answers have been just guessed. The mechanical side of correspondence has had expert attention for years. All sorts of highly efficient machines and devices have been developed. Business schools have annually trained their thousands of stenographers. Dictating machines have come to contribute their help. The routine of business letters has been highly systematized in thousands and thousands of business institutions.

But the human side of correspondence—that is where the failure has been. In most cases, dictators have "just happened." They have written important letters not because they have been trained, efficient correspondents, but because letters were a part of their jobs, something that "had to be done." As regards efficiency in letter writing and such natural business questions as I have started this article with, they were accomplished or solved only as a matter of haphazard.

There should not be unanswered questions such as those I have enumerated in any business organization. Where they exist, plain good business demands that they be eliminated. It is the job of the correspondence supervisor—which is what I am leading up to—to answer such questions and in so doing to solve the problems which are connected with them.

What the Supervisor Does

Correspondence supervision, as it is practiced today in some of the country's largest and most successful business organizations, is built around the letter expert, the supervisor, who gives a part or all of his time to the organization, depending on its size. The supervisor may be described as a combination of expert, systematizer and trainer. As an expert he is partly good business man, partly psychologist, partly literary person. By virtue of these qualities he knows personally how to apply business judgment to a letter problem and how, in meeting that problem in a letter, to cause in the addressed person the reaction desired. The supervisor himself is a capable, clever business letter writer.

As a systematizer, the supervisor straightens out correspondence conditions. He standardizes letter forms. He develops the most efficient routine. He introduces a systematic method of reaching all correspondents with the general supervision plan.

As a trainer—and here I like to compare his functions to those of the baseball manager or the veteran theatrical producer—he takes raw material, probes it for natural ability and makes the most that human skill can of such precious aptitude as he finds. The supervisor trains men to write good business letters. Occasionally he finds and develops a star. More often he does not—only one man in many, no matter what the accident of birth, environment and education—can become a star letter-writer. Always, however, the supervisor can raise the level of individual letter-skill. He turns the "hopeless" correspondents into "passable," the "passable" into "good," the "good" into "extra-good."

In performing such functions as I have indicated, supervisors use widely different methods. The character of the individual organization, the type of dictators, the kind of business the concern does—all these fundamentally enter. Sometimes the supervisor's contact is only by letter, dealing with each individual's letter methods. Here general instruction is pursued by means of the correspondence manual or by a series of bulletins on letters sent out weekly or monthly to all correspondents. In other cases the supervisor has personal contact and interviews weekly or oftener with the dictators. Methods inevitably vary, but the general aim is always the same.

I have said that it is the supervisor's job to solve such problems as I stated in beginning this article. From the angle of the supervisor I am going to deal with a couple of these questions in this article. The information itself will be of interest. It will gather further appeal

from the general subject of correspondence supervision to which it relates.

Can a Woman Write Letters About Machinery?

The project which S. L. Betts has in hand is significant, in its general as well as particularized aspects, to all business organizations. Concerns which manufacture or handle machinery should especially heed the points involved. The whole tendency of the times points to continued extension of the fields in which female labor can be used. Should we look for correspondents to the ranks of girls and women and build a plan for systematically developing these employees as they are needed? There might be economy and—who knows—added efficiency, in the plan.

We have discovered unguessed powers in women in recent years. Is it possible that we have overlooked something here? Can training make a picked eligible girl into an efficient letter writer, just as training will make her a good stenographer?

Supervision has exact information on these questions. The best business letter-writers will always be men because business ability, business enterprise and business keenness will always reach higher levels in man than in woman. Business judgment bears a critical relation to business letter-writing, and men have it in greater proportion than women. On the ground of business experience alone girls and women will always lack as a class in this necessary back-ground of good-letter skill. Business is man's life-work. Business is woman's stepping-stone, or interim occupation.

Sex differences between man and woman also enter. The principles here would, enlarged, make a book. Briefly, the part woman plays in the perpetuation of the race has, normally, a tremendous influence on her type of mind. Man is naturally adventuresome, enterprising, imaginative, ambitious. To meet family responsibilities and simultaneously throw great energy into his business endeavors is second nature to him.

It is not so with woman. Her normal interests, unlike man's, are narrow and restricted, centering about motherhood. Being a father and several other things simultaneously is man's nature. Being a mother and several other things simultaneously is not woman's nature. The function gets woman's all, or very nearly all, normally; even when, as so often happens now, woman enters industry, her normal woman's nature asserts itself in the unenterprising attitude she usually maintains toward her employment. Her instinctive attitude toward business is to regard it as interim employment. Instinctively in her, ambition, imagination, and enterprise, are curbed.

There are numerous exceptions to the rule, but the fact remains that woman is not a natural-born business person and man is just that.

We find the explanation in the same fundamental difference—sex—which explains why women can bear much greater physical pain than men. A different manifestation is the fact that women don't make humorists. All great humorists are men.

From the letter standpoint, the significance is in the degree of capacity. First, the ordinary business experience woman gets does not develop in her business judgment. Second, in respect to systematic letter training, the potentialities of the average woman are inferior to those of the average man. As a general proposition there is little incentive to experiment in this field as S. L. Betts started out to do. Woman's limitations here are definite and very marked. Within those limitations, however, there is room to use woman correspondents. It is being done successfully in some of the largest business organizations in the country, the national mail-order houses. Where correspondence resolves itself into a few routine situations, requiring relatively little letter skill, girls can be trained to write adequate letters. Sears, Roebuck & Co. does this, for instance. The girls write their own letters on the typewriter. It is a low-cost system. Moreover, the girls, trained by a supervisor, do good work. I have seen their letters and know. They deal with simple situations, however, writing certain kinds of letters over and over. The merchandise sold, too, lends itself to the plan. Housewives order a large percentage of the merchandise that Sears, Roebuck & Co. sells. It is merchandise for the home. There is nothing incongruous in girls writing letters to consumers about such merchandise.

On the other hand, machinery is something normally of such alien interest to the female mind that training girls to handle correspondence concerning it is not practical. They do not understand mechanical principles. They are not interested in them, or in machines. Writing letters day after day about machinery, they fail to grasp their subject, even when all the skill of an expert helper, the supervisor, is applied to the problem. I could refer S. L. Betts to a correspondence supervisor who has dealt with this very same problem and who determined that it was impractical. The women were patently out of their depth and eventually were transferred to other work. The letter expert had made some headway with them but little beside that which equal effort would have accomplished with a man. "Women have their limitations here," he says, "and it is folly not to recognize them."

At Sears, Roebuck & Co., supervision turns a girl high-school graduate into a competent correspondent in six months to a year. That is how efficient the supervision system is. Extensive use of woman correspondents, however, is only among mail order houses and concerns whose product or products are within the woman's field. There is no indication that the machinery industry can use female correspondents. On the contrary both theory and experience are decidedly against it because of the degree of business judgment demanded and the nature of the general product.

The Problem of Jim Benedict

In their letter-writing troubles, the Jim Benedicts of the country were without friends—except their fellows in misery—until the supervision system came along. In industrial and business organization, positions of authority and responsibility are held by men who qualify by virtue of definite knowledge, experience and aptitude, technical ability, the power to handle men, the ability to sell goods, loyalty to the firm and knowledge of the line and the trade. A combination of things, or one outstanding quality maybe, lands a man in a responsible job. Most of the business letters of the United States are written by such men. Most business letters always will be. Nevertheless, the lack of letter-writing skill often characterizing an official holding an important position is no light matter. There is something more than inconsistency in the spectacle of a department head 95 per cent efficient, or better, in performing all other duties, whose letters grade 35 per cent or lower still.

It was probably true that Jim Benedict, referred to

in my question number one, was losing business right along for the company. Meet Jim in person, and you find him the sort of person easy to get along with. He sees that things go right in his department, but there are no fireworks in the process. There is a look about Jim's eyes and around his mouth that win your liking. And meeting men face to face, the man is tactful, diplomatic. I think it is not so much in what Jim actually says or doesn't say, as in the way he looks and acts. It smoothes your fur the right way—if you know what I mean. In letters, Jim is awkward, abrupt, cold. He doesn't put his smile, or anything like it, in a letter. He doesn't know how to break bad news gently and good news he butchers in the telling. He has caught at stereotyped phrases, like "Yours received and contents noted," and clings to them as though to life-savers. Often he says too much in a letter and at other times he says far too little.

Jim's Letters Lack Business Punch

Letters with Jim are just something to be got through. When he dictates, his stenographer would pity him if Jim didn't do his darnedest to look self-possessed and in his element. At heart he knows he writes "bum" letters but he thinks of them—as do most of the Jim Benedicts—as something which can't be helped. He writes letters not because he knows how to, or wishes to, but because they are a part of his job. And as fate has ordained it most of the letters he must write are a difficult kind of letter. Adjustment letters always are. Of course it's easy to say what you can or what you can't do—to concede, or refuse. But that isn't enough. The function of the good adjustment letter is more than simply to do something in satisfaction or otherwise of a customer's complaint. *It must hold the customer.* Lord knows, Jim's grammar isn't much. Jim, Jr., now in the fifth grade, could pick plenty of flaws in it. But we are not arraigning Jim Benedict, letter-writer, on literary grounds, but on business grounds. His letters have definite business functions to perform, and Jim, dictating an important reply, muffs the ball.

Every supervisor lifting the level of company letter efficiency has Jim Benedicts to train—often dozens of them in the same organization. In making the Jims into correspondents who handle their letters acceptably, or better, the supervisor necessarily adapts his methods to the individual. There is the matter of Jim's good will to be got, initially. Jim must be reconciled to the advent of this new expert. Jim's co-operation must be won. Right here is one of the toughest problems the supervisor usually meets with.

Will Teach Jim Some Psychology

I cannot predict how long it will take to convert Jim into a better correspondent, nor the exact methods the "letter doc" will use. But I can indicate some of the things that Jim will be taught.

Jim is going to be taught some psychology. That's a hard word; call it "human nature" if you want to—it doesn't matter. Jim will be taught to use "Dear Mr. ———" instead of "Dear Sir" in every situation where the customer relation justifies. This detail will help a little. Jim never heretofore has got beyond the "Dear Sir" stage, absurdly stiff, cold and formal to men the company has dealt with for years and years and considers, or should consider, friends.

Jim will be taught to use such words as "sorry," "regret," right and left in relation to situations in which the company appears to be at fault. It'll be hard for him. He's loyal to the house, and he's strong for dignity, but it'll have to be, because Jim *has got to hold customers.* Jim Benedict by-and-by will have fluent command of "sorry," and "regret," and along with them, "glad," "pleased," and others of that general family. When Jim makes an adjustment he isn't just going to let it go at that, as he always has. He's going to say the company is glad to do it. And if he can't oblige the customer, he's going to say the company is "sorry."

Jim's Lack of Tact

Jim's use of explanation in adjustment letters will also be revised. I was shown one of Jim's letters yesterday, making an adjustment but making it grudgingly. The company had fallen down in its service—that was the plain fact. Accidents will happen. A customer sarcastically had kicked and it had made Jim sore clean through. He had to make the adjustment in conformance with company policy—personally, Jim never would have—but got satisfaction for himself with a letter which attempted to justify the oversight. He was sore, you see, and did a very human thing. But it wasn't a business thing. Jim's explanation would only start an argument with the other fellow. It would spoil half or all the satisfaction the adjustment otherwise would have furnished the latter. The customer should have been mollified by the letter, written right. But he wasn't by the one that was written, which Jim really wrote, not to mollify but get resentment out of himself.

"In letters which must refuse a customer's request," the supervisor will tell Jim, "explain just why and at as great length as seems needed. You can't satisfy the customer by making the adjustment asked for and your object should be to satisfy him by convincing him the company has adequate ground for refusal and is only doing what is reasonable under the circumstances. Try to make the letter reflect a fair, reasonable, meet-you-more-than-half-way spirit. Look out that your explanation isn't abrupt or impatient. Say you're sorry you can't make the adjustment—use the word 'sorry.' And here's another thing. Don't argue. Don't feel obliged to point out the absurd or the ridiculous in the customer's appeal. Don't disagree with a customer except as you absolutely have to and then do it in a courteous, reasonable way, not so much trying to show the customer wrong as to indicate just what the company's position is and why it is right."

Short, Snappy Adjustments

That's just tact, of course. A more difficult task will be to wean Jim from his worst habit—making adjustments grudgingly. There is no necessity under ordinary circumstances for a letter which adjusts to the customer's satisfaction to go into long explanation. The adjustment's the thing and it ought to be announced in the first sentence. Such explanation as is given should not be to justify the mistake or fault but as a courtesy and a form of regret. The impulse which prompts explanation should be regret, not resentment. Jim's explanations are always of the latter variety except in the case of refused requests in which case he is cold and abrupt.

The supervisor will change all this. Also, he'll get Jim out of the habit of using stale phrases. He would write fifty per cent better letters if he took double the time over them. He writes his letters "any old time"

he can sandwich them in, often the tag end of the afternoon when he is mentally fagged. The supervisor will make Jim systematic about letters. He will insist probably on a regular hour for dictation—in the forenoon.

Any time Jim gets stuck on a difficult letter, he will be free to appeal to the supervisor for assistance. And when the supervisor criticizes it will be constructively with the right way clearly illustrated for Jim's benefit. Jim Benedict will never make a star correspondent but I can predict in advance that he will be turned into a satisfactory one. He will learn how to write adjustment letters which, while not literary gems, will hold customers.

Correspondence supervision is a new thing. The number of concerns using it is still very limited. Some of the supervisors have hundreds of correspondents under them, scattered all over the country because of the branch form of company organization. In other cases the number is only a handful. But whatever the concern with respect to size or product the attitude of the supervisor toward correspondence is always the same.

The supervisor's attitude is a business attitude. "The kind of letters we write," he declares in effect, "has a great deal to do with the volume of business we secure. Poor letters lose customers. Good letters hold customers and turn them into permanent friends of the house. My job is to raise the percentage of good letters until it is as near 100 per cent as it is humanly possible to get it."

There are a thousand and one details to supervision work which need not be touched on here. The essential thing to realize is that supervision performs an essential and vital business function. It brings dollars and cents in returns to the concern employing it vastly out of proportion to its cost.

A Railroad Shop's Apprentice School

Apprenticeship in This School Compelled by the Crafts—Current Expenses Defrayed by Assessing the Apprentices—Regular and Helper Courses Given

By J. V. HUNTER
Western Editor, *American Machinist*

AN INTERESTING apprentice training school has been opened in the Decatur locomotive and car shops of the Wabash Railway Co. This step was urged by the shop crafts organization, with the offer to underwrite a portion of the expense of starting the school.

The leaders of this organization expressed the desire that their apprentices should have a better grounding in many fundamentals than they were receiving under the old system, and finally co-operation with the railway's shop officials resulted in arrangements that enabled the school to be opened in September, 1920.

The railway company furnished an old coach and fitted it up to make the very excellent classroom shown in Fig. 1. The coach was put in first-class condition and freshly painted, the inside receiving a glistening coat of white enamel to give the proper light for drawing classes. It stands on a siding adjoining the main locomotive shop and is attached to the shop steam and electric lines for heating and lighting. The company also supplied the chairs and drawing tables.

The crafts organization supplied a full equipment of drawing instruments and the necessary class books, and obtained an instructor from the local manual training high school to serve for the whole of each Saturday. It also guaranteed his salary for these services.

To defray all current expenses apprentices are assessed the sum of $1 per month, which assessment is made directly from their pay checks by the company and turned over to the local crafts organization for dispensing. This sum was found to be sufficient for defraying all expenses and also provides a sinking fund that by the end of two years will reimburse the original investment in equipment and supplies.

FIG. 1. APPRENTICE SCHOOLROOM IN THE DECATUR SHOPS OF THE WABASH RAILWAY

The students are selected from the three trades that have subscribed to the agreement regarding the maintenance of the school; namely, the machinists, boilermakers and pipe fitters. It is hoped within a short time to have the blacksmiths also co-operating and their added number will enable the formation of another class. As the Saturday schedule is now filled, this fourth class will have to be held some time during the mid-week and is planned as another drawing class, for which it is expected an instructor will be assigned from the local drafting room of the railroad company.

The course of studies as at present organized consists of arithmetic, advanced mathematics and mechanical drawing. To each of these a class of twenty-two has been as-

signed, this number representing the full capacity of the classroom. Attendance on the part of the apprentice is compulsory, and the method of class arrangement is fully explained in the original shop bulletin issued on this subject, which is quoted verbatim as follows:

WABASH RAILWAY COMPANY APPRENTICE SCHOOL

The apprentice school will begin session on Sat., Sept. 5, and will be in session each Saturday thereafter.

The first ten Saturdays' instructions will be given in arithmetic, advanced methematics and mechanical drawing. Two hours' time will be allowed for each subject.

The first class will be for arithmetic. All apprentices assigned to this class will quit work at 8 a.m., clean up and be prepared to be in school at 8:10 a.m. and continue in session until 10:10 a.m.; the advanced mathematics class will quit work at 10 a.m. and be prepared to be in school by 10:10 a.m. The mechanical drawing class will quit work at 2 p.m. and be prepared to be in school at 2:10 p.m.

As soon as apprentices are excused from school they will return immediately to their respective jobs.

All apprentices in service eligible to attend school will be expected to be on hand each Saturday and no excuse other than sickness will be accepted for leave of absence.

SHOP SUPERINTENDENT.

Previous to starting the classes the boys were all required to fill out application blanks showing the amount of schooling that they had received. These applications showed that some of the boys had high-school training while others only had a few years of ordinary grammar-school education. Assignments to the classes were made from a study of these lists, being arranged so that those who had deficient school training should start first in the elementary course in arithmetic. The class in advanced mathematics covers such subjects as decimals, square and cube root and elementary algebra. The class in mechanical drawing will study this subject from the beginning and advance through all stages according to the students' proficiency in this work.

TABLE I. REGULAR APPRENTICE RECORD CARD

Name..... Date On..... Date Off.....

Moves	No. Boys	Days on Job	Date On	Date Off	Performance	Days Lost	Foreman
Bolt Lathes	3	36					
Shapers	4	36					
Slotters	2	36					
Lift Shift Lathe	1	36					
American Lathe	2	36					
KneeType Miller	2	36					
Crank Planer	2	36					
Bullard 24 in.	2	36					
Bullard 36 in.	2	36					
Turret Lathe	2	36					
Brass Lathe	1	36					
Cylinder Bor. Mill	1	36					
Piston Grinder	1	36					
Piston Job	1	36					
Rod Job	1	36					
Engine Truck Job	1	36					
Brake and Fire Door Job	1	36					
Tank Valves and Steam Pipe	1	36					
Link Job	1	36					
Valve Bench	1	36					
Swing Job Lathe when open	1	..					
AIR ROOM	6	75					
Injector and Lubricator	..	..					
Cab	..	..					
Bells and Air Reverse	..	..					
Governors and Generators	..	..					
Pump	..	..					
Engine Brake Valve	..	..					
TOOL ROOM	2	75					
Lathe	..	..					
Miller	..	..					
Grinder	..	..					
FLOOR GANG NO.	..	..					
Cab Job	4	36					
Shoe and Wedge Job	4	36					
Valves	4	73					
General Work	4	73					
Round House	4	73					

TABLE II. HELPER APPRENTICE RECORD CARD

Name..... Date On..... Date Off.....

Moves	No. Boys	Days on Job	Date On	Date Off	Performance	Days Lost	Foreman
Bolt Lathes	3	36					
Shapers	4	36					
Slotters	2	36					
American Lathe	2	36					
Knee Type Miller	2	36					
Crank Planer	2	36					
Bullard 24 in.	2	36					
Bullard 36 in.	2	36					
Turret Lathes	2	36					
Brass Lathe	1	36					
Cylinder Boring Mill	1	36					
Brake and Fire Door Job	1	36					
Link job	1	36					
Valve bench	1	36					
Swing job lathe when open	1	..					
AIR ROOM	6	75					
Injector and lubricator	..	..					
Cab	..	..					
Bells and air reverse	..	..					
Governors and generators	..	..					
Pump	..	..					
Engine Brake valve	..	..					
TOOL ROOM	2	75					
Lathe	..	..					
Miller	..	..					
Grinder	..	..					
FLOOR GANG NO.	..	..					
Cab job	4	36					
Shoe and wedge job	4	36					
Valves	4	73					
General work	4	73					

Arrangement of the classes is in terms of twelve weeks each, and after the finish of the term it is planned to promote students from one class to the other. Attendance at these training classes must be continued by the apprentice throughout his entire training.

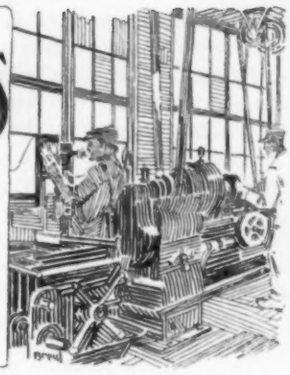
Another step toward the better training of apprentices in the shop has been made by the company through the assignment of a regular instructor who will have full control of the training of the boys during the working hours in the shop. This instructor will assign the boys to the machines, teach them in regard to the setting of tools and the handling of all their work, and generally devote his time to giving them instruction that is desirable for the education of a finished mechanic. There are two classes of apprentices in the shops, one serving a course known as the "regular apprentice" and the other the "helper apprentice." The length of shop service for the first of these is four years and for the second, three years.

For each of the regular apprentices in the machine-shop course a printed card is filled out similar to that shown in Table I. This shows every machine and job which he is expected to serve while in the shop and the amount of time to be devoted to each of these. The instructor keeps up this card record, noting on it the time an apprentice started and stopped his various machine assignments and his performance while on each type. Jobs of work coming into the machine shop that can be handled by an apprentice are turned over to the instructor, who in turn gives them to an apprentice and sees that the work is completed satisfactorily.

The helper apprentice only serves a total of three years in his apprenticeship. His machine training is not so extensive as that given to the regular apprentice and his assignments for all classes of work is also kept by a chart card which is similar to Table II.

MODERN PRODUCTION METHODS

By
W P. Basset
of
Miller, Franklin, Basset & Co



XIII. Departmentalizing the Overhead Expense

The Complex Problem of Proper Distribution of Overhead — Examples of Incorrect Distribution — Relative Proportions of Productive and Contributory Costs

"LAST year, the overhead expense of my shop was 100 per cent of the labor and material cost. How does that compare with other machine shops? Is it high or low?"

That question was asked me recently by the owner of a machine shop which, I knew, was not making nearly the profit it should make, considering the excellence of its product and the breadth of its market. In nearly identical form, it has been asked me, I suppose, a hundred times by men in nearly every kind of manufacturing. That a man looks upon all of the expenditures that he makes for other than labor and material as a "burden" of the business as a whole, and allots it in proportion to the amount of labor and material each item of output contains, shows lack of thought. It would be almost as accurate to apportion the overhead on the basis of, say, the color; if painted red, the product would carry $10 of the overhead; if blue—$20; yellow, $50. Nearly every other inaccurate method has been used, apparently.

The tendency to lump overhead and then to distribute it over the entire output on some system or other, shows how little careful thought has been given to just what overhead is and what causes it. The fact is that overhead is complex; it consists of many charges for many purposes mixed together, as a rule, into a lump sum, thanks to the accounting methods of old time bookkeepers who were interested only in lump sum figures of profit for the business as a whole, at the end of a year.

If a shop made but one thing, a 10-in. pulley, say, this lump sum of overhead could be divided over the output. Then, if the overhead were $100,000 a year and the output were 100,000 10-in. pulleys, all alike, each pulley would carry the same overhead, namely, $1. And that would be the figure whether we divided the overhead by the totals produced, on the basis of a percentage of the labor and material, on the labor alone, the material alone, or the productive hour basis.

But there are practically no single-product plants. Even though the shop made nothing but cast-iron pulleys, it would make them in different sizes and styles That means that one pulley would take up more floor space in moving through the plant. Another would take longer to go through one process and a shorter time to go through another process. When we consider that the overhead expense borne by a unit of output is really the rent paid by that unit to the business for the use of the facilities which the business furnishes, it is evident that seldom will two different items of output carry the same amount of overhead expense, any more than they would be likely to carry the same amount of labor and material cost. The exact basis for allocating overhead expense so that the correct proportion will find its way to the individual items of production will be discussed in a later chapter. Our present problem is to gather the expense in such a way that it may ultimately be accurately charged to every unit produced by the plant.

For the sake of effective supervision, it is common practice to divide a machine shop into departments so that each foreman will have under his charge operations or machines of a type with which he is especially familiar. The executive who gives thought to the whys and wherefores of his business has realized that his complex manufacturing plant is thus in reality a group of small, specialized plants. As a business grows, it is common practice to bring more and more of the manufacturing processes under the ownership and control of the parent plant and to rely less upon outside manufacturers for the preliminary manufacturing of raw material. The most elementary manufacturing—and there is a great deal of that kind still done—consists of buying all of the component parts of an assembly in their finished state from outside suppliers and simply assembling those parts in the plant.

Since each department in the complex factory can be considered as an individual business, it is logical and, fortunately, accurate, to develop the overhead burden for each department as though it were a separate business. This fits in with the demands of accurate cost accounting for it has also been found that since the activities of different departments are essentially different, it is frequently necessary to distribute the overhead expense for the various departments on different bases.

We have seen in a preceding article that the machine tools in a machine shop may be arranged in batteries where all machines of a type are grouped or in units, where the machines performing consecutive operations on a part are arranged in order. This is called the unit layout. From the cost accounting point of view, either arrangement of departments is satisfactory. Because the battery arrangement is that most com-

monly found, we shall in the present series of articles deal with the cost problems in such a shop.

None of these batteries or units could properly be consolidated for cost purposes, although for purposes of operation they may be under the same supervision. Lathes and milling machines cannot as a rule be grouped for cost purposes in the same department because, although the machines may be approximately the same size and so take up equal amounts of floor space per machine, and be of relatively equal value, that is, take about the same insurance and depreciation charge, the tool usage is widely different. The lathe tools are relatively cheap but the milling cutters are so disproportionately valuable that if both classes of machines are grouped in a single department, lathe work going through that department would appear to be high in expense cost because of the absorption of some of the charge for milling cutters that would be made to the department.

Now we often find that lathes and planers use the same kind of tools—so far as cost goes. Yet these two machines cannot be grouped in one department, due to the disproportionate amount of floor space occupied.

The typical machine shop may have any number of manufacturing departments. Each of them, we want to emphasize, is a separate manufacturing business. Were each of these manufacturing departments in reality a separate plant, widely separated and under separate management, they would each need a general superintendent, an office, a selling staff, a toolroom, a boiler room and so on. One of the advantages of being under a single management and under a single roof, is that they all can be served by one superintendent, one selling staff, one boiler room and so on; and, by each of the manufacturing divisions bearing its just share of these general expenses, the expense for each is reduced.

Productive and Contributory Departments

We are now at a point of the discussion where it becomes evident that the departments of a machine shop may be separated into two groups; those which actually perform manufacturing operations on the product and which are therefore called "productive" departments, and those departments which serve either the productive departments or the business as a whole and which are therefore called "contributory" departments. For the typical machine shop which we are discussing, we set up on the fixed charge sheet as "productive" departments the lathe, milling machine, planer, automatic, assembly, polishing and hardening departments, and as contributory departments we showed the boiler department, the power department, the toolroom, the office, the general factory and the shipping department. The selling department is not included in the manufacturing cost, but the methods of handling selling expense will be taken up in a later article.

While, in practice, these departments may often approximate the geographical divisions of the plant, it is not essential that they do so. It is important to keep this point in mind. Any collection of workers or equipment may form a department, with the result that we may have in a single room several departments, while another department may occupy several rooms. It is often good practice to set up a single expensive machine as a department. The real test of the unity of a department is, "Can the overhead expense of this department safely be distributed over the output of the department on the same basis?" If expensive machines were in the same department with inexpensive ones, this could not be done. We therefore do not group in a single department hand work and machine work, nor do we group in a single department machines which require expensive tools, such as automatics and milling machines, with those requiring inexpensive tools, such as drill presses; nor do we, as a rule, include very expensive machines in the same department with inexpensive ones.

An exception to this rule is in the shop where the unit line-up of machines is used. For, of course, in such a line-up, there may be a dozen machines of different types ranging from the least expensive to the most expensive. But we really consider such a group of different machines as a single semi-automatic machine performing a regular sequence of operations. There is, therefore, no error in considering such a line-up as a department.

Contributory Department Divisions are Arbitrary

In determining the contributory departments, their divisions are more or less arbitrary and obvious, but the correct division of contributory departments is essential to accurate machine shop cost accounting. No matter how elaborate the routine of collecting labor and material costs may be, if this big item of overhead expense is not finally distributed accurately to the various units of output, the final costs will be worse than useless. Ignorance of costs, like ignorance on any subject, is less dangerous than false conviction. The manufacturer whose various lines of product are carrying incorrect amounts of overhead, but who is convinced that his overhead is spread correctly, is traveling toward bankruptcy, for he will be selling some of his lines at a loss and failing to sell his profitable lines because he has priced them too high. Inasmuch as errors in spreading the overhead can, in ninety-nine cases in a hundred, be traced back to incorrect departmentalization, it is evident why I lay so much emphasis on the importance of getting these items correctly laid out in the first place.

The point to consider then, in laying out the productive departments, is to ignore the size of the department and its geographical location and contour. It may be an entire building or a single, high-priced machine. The ideal department will consist of machines having the same value and costing the same to operate, and all the employees in that department will receive identical wages. Of course, it is seldom possible to meet this ideal. Practically, it is sufficient to group machines and employees of about the same operating cost or about the same wage scale.

Admittedly, the division into correct productive departments may sometimes be intricate and difficult, but in any plant it is entirely possible to strive toward the correct departmental divisions. Without them, no distribution of overhead can be correct.

Now, there are many items of expense which can be charged directly into the productive departments. The wages of the department foreman and the supplies in that department are examples. We also charge directly into the productive department its share of the fixed charges from the fixed charge sheet, which was described in Part XII. Other items that can be

charged directly to the productive department will occur to every manufacturer. They are such as the time of set-up men, non-productive labor such as inspection labor, belting, cutting compounds, lubricating oil, waste and so on. Labor and materials for repairing machines is such a direct charge; but the expense of the maintenance department, whether there is a separate maintenance department or whether this work is done by the toolroom, is distributed at the month's end, in proportion to the amount of labor and material so absorbed. The time of crane men is often charged in the same way, with the expense of the crane following it. This is especially true of shops doing a mixture of light and heavy work.

The cost of making special and general tools is handled the same way. Spoilage is charged directly to the productive department where the spoilage occurred.

But, as we have seen, there are certain departments which contribute to the welfare of the business as a whole and thus to the welfare of the individual productive department. Since the productive departments benefit by the expense of the contributory departments, we must make them bear a share of their expense, in fact, among all of the productive departments, they must absorb all of the expense of all of the contributory departments. It is easy to see how the total expense of the power department can be distributed among the productive departments. This is done in much the same way that the fixed charges are divided. We know what the total consumption of power is, and by simple tests, we can determine the normal consumption of power by each department. The total power expense will thus be divided among the productive departments on the basis of their normal consumption of power. The cost of heating will be absorbed in the same way. Occasionally, we find a plant equipped with consumption measuring devices. The task of distributing the heating and power costs is then much simplified. The expense of operating the boilers is distributed between the power and heating on the basis of the steam consumption for each purpose. Where exhaust steam is used for heating, it is common practice to charge 10 per cent of the boiler expense to heating. The heating may be distributed on a square-foot basis or on the radiation used in each department.

Office Department Expense Simple

It is simple enough to gather the expense of the office department which obviously facilitates the work not only of the general factory, but of the selling department. For the individual business, an analysis of the office's activity will show about what percentage should be charged to the selling department and what per cent to the general factory. This division once set up, will govern unless a radical change in the activities comes about, warranting a new basis for dividing office expense.

This brings us to consideration of the contributory department which we set up as "general factory." This department facilitates the operation of the manufacturing departments of the business, but only such charges are put into general factory as cannot be directly charged to a productive department. For example, we may be paying a general superintendent $6,000 a year. One month he might give nearly all of his attention to the affairs of the automatic department. Normally, however, his attention is spread impartially over the entire plant. Among other items of expense which are properly chargeable to the general factory department in the typical machine shop, are a share of the executive salaries, the superintendent's assistant, cost and planning clerks, janitors, general or inter-department truckers, watchmen and so on. Yard men usually turn in time cards which apply part of their time direct to certain functions. Thus, unloading coal would be charged to the boiler department, loading cars to selling expense, or maybe to a specific sales order. When all of these expenses have been grouped and totaled, they must be distributed to the manufacturing departments on some fair basis. It is in this distribution that much specious reasoning is done with very sad results in the accuracy of costs.

Some Incorrect Methods

Let us consider briefly, some of the incorrect methods in order to emphasize some of the fallacies. It would be entirely possible, for instance, to spread this general factory expense among the productive departments in the same way that the depreciation of plant was distributed, that is, on a square-foot basis. I have seen this done. But we must remember that general factory is largely a supervisory expense. What connection could there possibly be between the floor area of a department and the effort of supervising it? One department, for instance, might contain several thousand square feet and yet be much more easily supervised than a department less than 500 square feet in area. This leads us to see that supervisory expense is really dependent upon the number of human beings or machines in a department, but as some productive departments will have many machines and few workmen, while others will have many workmen and few machines, we obviously come up against a difficulty if we try to divide the expense on the basis of the number of machines or number of men in a department.

Our next thought might be that we can make a department with a large payroll bear a proportionately larger share of general factory than the department with a small payroll. But we run up against several obstacles here; the one just mentioned and another which arises from the fact that we may have low-paid unskilled labor in one department, and highly paid, highly skilled labor in another. The highly skilled labor usually requires less supervisory expense than the unskilled, so apparently we cannot use this system of distribution.

The method in almost universal use—although not 100 per cent correct—is to divide the general factory expense among the productive departments on the basis of the productive hours of each department. We, therefore, from the payroll, determine the total productive hours for the plant and for each of the productive departments in the plant, and divide the general factory expense among the departments in the same ratio that the departments' productive hours bear to the total productive hours of the plant. This method is not entirely correct but is in accord with the best common practice and has been the accepted theory. For the usual run of machine shops, it probably is practically correct, but for the shop which has a disproportionately large amount of hand work or automatic machine work, special division and distribution of the general factory expense should be resorted to. As this comes under the case of special conditions it cannot well be treated in this article.

We have now shown the plan of departmentalizing the factory and have indicated how the entire overhead expense is gotten into the productive departments. We have not yet traced the non-productive labor and the non-productive materials or supplies from the books of original entry to the departmental expense. This we will do in the next two articles.

From the above, it will be seen that a method for distributing and handling the expenses of the various departments must be provided. While we have indicated how some of the items of expense find their way from the original invoices into the departmental burdens, we have not shown the mechanics by which these expenses are kept track of and are checked against the controlling account in the ledger.

In order to allocate the expenses to the departments, and to give the executives a means by which to check undue expenses in the various departments, we set up and maintain a record which we call the "expense analysis." This is one of the most important records in cost accounting. We have already said that any cost system which did not check with the general books was of little or no value. Therefore this expense analysis must check with the balance of the manufacturing expense account as shown by the ledger for the period. A study of the expense analysis, Fig. 60, shows that each sheet is arranged to take care of a department and that on each sheet for each department is shown in detail the various items of expense, month by month. Also you will note that a column is provided which is headed "normal." This column is to enable the executive to set up a standard or budget figure for each item of expense in that particular department, with which he can gage the actual expense for the item in question.

To save space, we are compressing the expense analysis to show figures for one month only. Actually the expense analysis is headed like that at the top of Fig. 60 to give a comparison for three consecutive months of the expense for each month and for the period to date.

The ledger account of manufacturing expense is made up of a series of debits and credits from the main books of original entry. In the manufacturing expense account shown in Fig. 57 there appears an item posted from the voucher register for $1,829.63. This amount we distribute to the various departments by means of the "Analysis of Expense from Voucher Register," shown as Fig. 61. On the left side of Fig. 61 are listed the different items of expense that have developed during the month. Across the top of the sheet are listed the different departments. At the extreme right hand of the sheet is a total column showing the amount against each item. The sheet is divided into two sections, the top part dealing with manufacturing expense which is controlled by the manufacturing expense account in the ledger, and the lower part dealing with the selling expense. At present, we are interested in the manufacturing expense items.

From the voucher register, we enter in the proper column on the proper line the various items of expense as shown in the manufacturing expense column on the charge register, which produces the result as shown on Fig. 60. From this form, we post to the expense analysis sheets themselves, against the different departments, the charge for each item that has developed during the month.

On Fig. 60 we show the expense analysis for all of the contributory departments and for one typical productive department, the automatic, which we will carry through as examples of the expense analysis as it develops. Each of these items on the expense analysis has after it small letters to show the source of that particular item. The letters V. R., for instance, indicate that the item came from the voucher register; F. C. S. from the fixed charge sheet and so on.

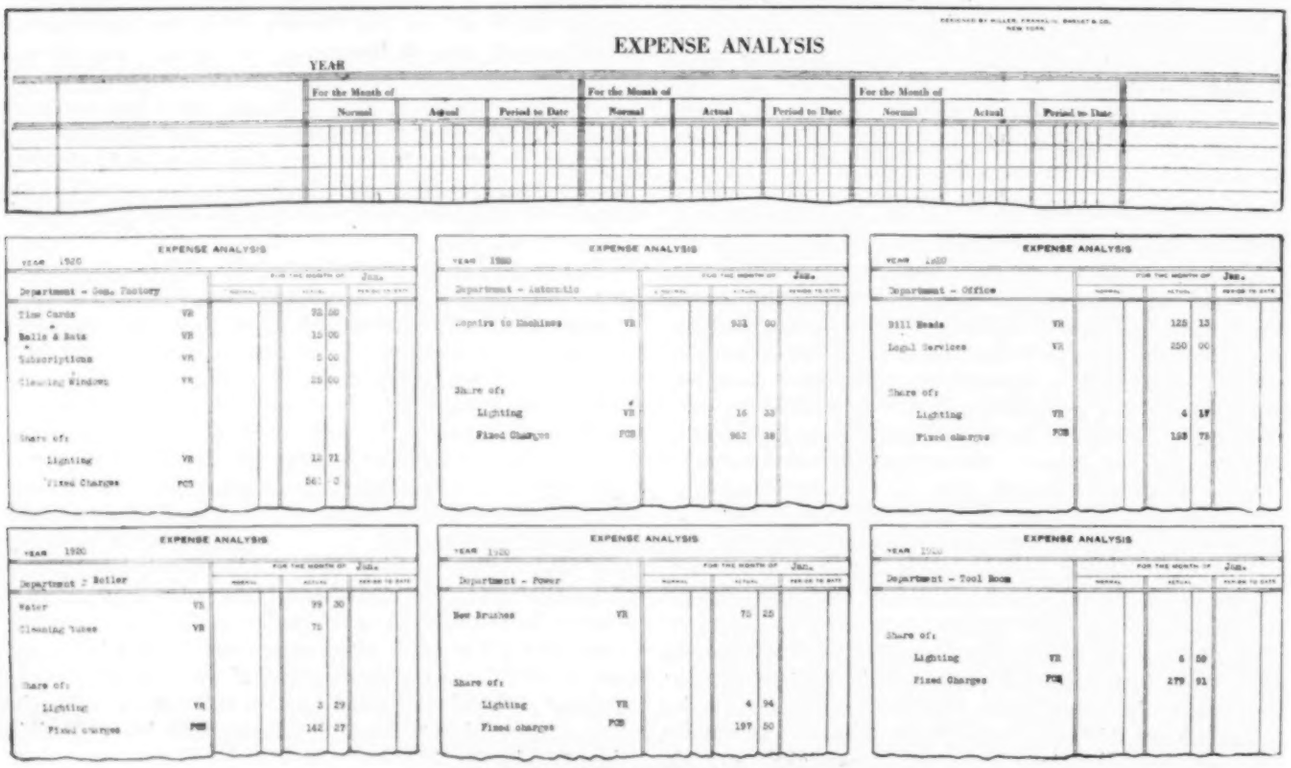
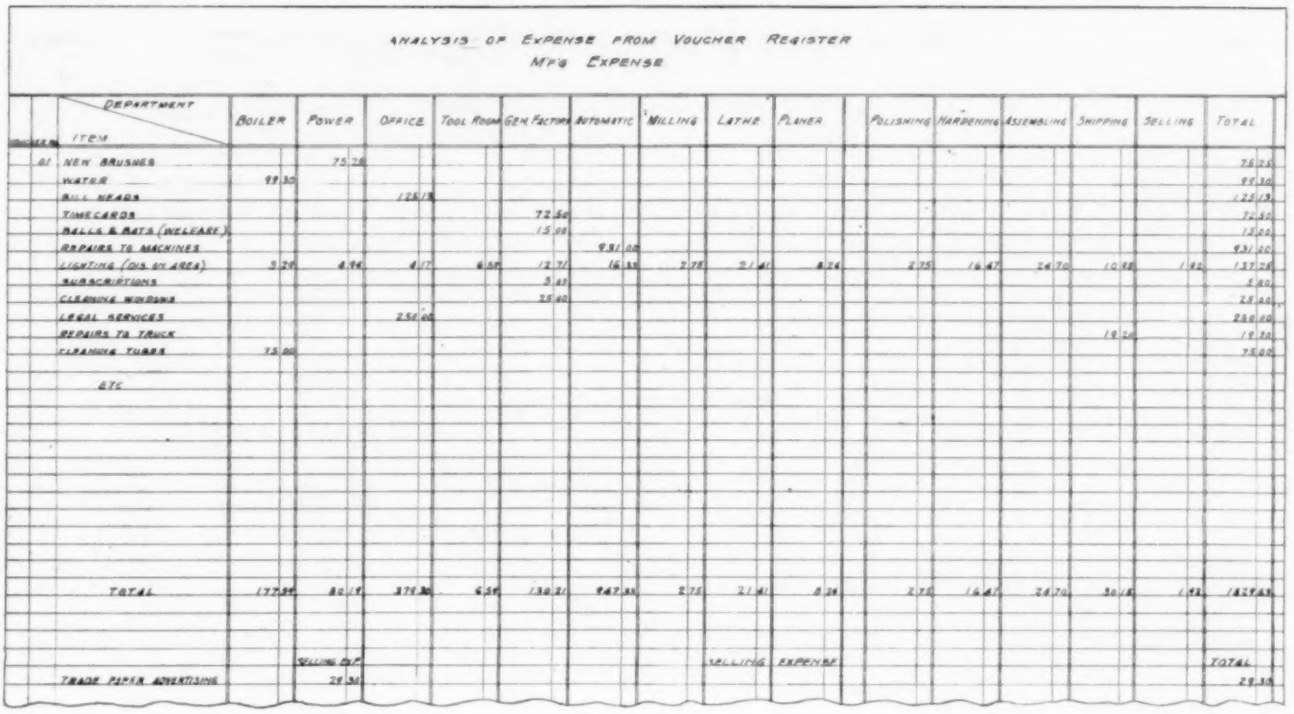


FIG. 60. EXPENSE ANALYSIS



ANALYSIS OF EXPENSE FROM VOUCHER REGISTER
Mfg Expense

Voucher No.	Item \ Department	Boiler	Power	Office	Tool Room	Gen. Factory	Automatic	Milling	Lathe	Planer	Polishing	Hardening	Assembling	Shipping	Selling	Total
61	New Brushes		75 25													75 25
	Water	99 30														99 30
	Bill Heads			125 13												125 13
	Time Cards					72 50										72 50
	Rolls & Rats (Welfare)					15 00										15 00
	Repairs to Machines						951 00									951 00
	Lighting (Oil on Area)	5 29	4 94	4 17	6 50	12 71	16 33	2 75	2 41	8 24	2 75	16 47	24 70	10 98	1 92	137 25
	Subscriptions					5 40										5 40
	Cleaning Windows					25 00										25 00
	Legal Services			250 00												250 00
	Repairs to Truck													19 20		19 20
	Cleaning Tubes	75 00														75 00
	Etc															
	Total	179 59	80 19	375 30	6 50	130 21	967 33	2 75	2 41	8 24	2 75	16 47	24 70	30 18	1 92	1827 84
			Selling Exp.						Selling	Expense						Total
	Trade Paper Advertising		29 50													29 50

FIG. 61. ANALYSIS OF EXPENSE FROM VOUCHER REGISTER

Insufficient space prevents showing the standing of the ledger accounts when the journal entry for the fixed charges has been made. This journal entry was noted on the bottom of the fixed charge sheet, Fig. 59. In the next article we will show the ledger accounts as they stand after this entry and those necessitated by the labor charges have been made.

On the expense analysis we are showing against each department the monthly charge made against it for fixed charge, that is for tax, insurance and depreciation. This figure shows in the extreme right-hand column of the fixed charge sheet, Fig. 59. As the different items of expense develop, we shall show the building up of the expense analysis. And when we have accumulated all of the various items and charges against each department, we will then show how the expense of the contributory departments is carried forward and absorbed by the productive departments. We will also take up at the completion of the posting of our expense analysis the method by which the expense of each department is relieved and how it finds its way finally into the cost of the finished article that has been fabricated in a given department.

That—to get every item of overhead expense into the finished product in the right proportion—is the ultimate end of cost accounting. It is most accurately and quickly done by means of the expense analysis.

Want Ads

BY CHARLES F. SMITH

On page 892, Vol. 53, of the *American Machinist*, A. W. Forbes takes exception to an article which appeared in a previous issue under the title "Putting Punch Into Help Wanted Ads." The only trouble I see is that the punch is misdirected.

I have been both employer and employee and have found many times that a good man may be found for a position that he can fill in every way, but his letter composition does not meet with the expectations of the advertiser; therefore, he will not take the trouble to look up the man's references, or have the common courtesy to reply to the applicant's letter. If the man is honest in his belief that he can fill the position advertised and shows it by giving reference to his past and present employers, it is his due that the advertiser should acknowledge his letter in some way, even if he is in touch with someone else who, he thinks, is better qualified to fill the position.

From my own experience it seems to me that most of the advertisements are blinds, as seldom have I ever received an answer from any of them. It may be that my composition is not to their expectations, or that my experience has been too extended to suit the position advertised or the price they expect to be asked is too high. Again it may be that my age is against me, although I am in middle life. Or it may be because I do not give a detailed explanation in a letter, for it would take many sheets of writing to do it, but give only a general outline of my experience which should be sufficient to let the advertiser know if it in any way corresponds with the line that he has to deal with. If so, he could write and ask any questions necessary after learning from my references that I am a man who can be depended upon and can qualify for the position open. And I have always supposed that references were called upon to substantiate the claims of the applicant, although sometimes what will suit one concern will not suit another.

I would suggest that the *American Machinist* have a "blue list" for advertisers for "Positions Vacant" and "Position Wanted," and only accept such advertisements as will bear the fullest investigation before publishing, each and every one obligated to answer all letters received. Of course an extra charge should be made to cover the trouble of looking up references and qualifications; it would also eliminate extortion demanded by the employment agencies.

Meeting the Present Emergency

By An Eastern Machine-Tool Manager

WE ARE bending most of our energies to the building of parts both for standard machines and obsolete repair parts, and to a limited extent, units and sub-assemblies. We go as far in the direction of building complete machines as our floor space will allow. There are certain objections to this, that set a limit to the practice, however, since under some conditions of bookkeeping in connection with the present income tax and excess profit taxes, a given amount of labor and material would show a higher inventory value of finished machines than it would in any other form. This means there would be a higher book profit at the end of the year, and a higher tax, even though not a machine was sold and no money was made.

The present excess profits and war tax penalize the company which tries to keep its plant going and its men employed, and makes it almost absolutely necessary for most firms to shut down flat if they are to exist in times like these. That is one of the many advantages of that particularly beautiful piece of legislation.

Our principal task is to maintain our organization. It is the most valuable piece of property which the company possesses, far more valuable than the patterns, the drawings, the shop, the machinery, or the goods and material in stock. For this reason, we plan in such times instead of laying off a certain percentage of the men to run the whole shop a certain percentage of the time, so that the whole organization may be carried along as long as the money lasts; and the whole problem of running the shop becomes one of making the resources last as long as possible in holding the organization together.

In this connection, times like these are the ideal times in which to push new developments whether in machinery, tool design, method of work, improvement of shop processes, or anything else that may be important. The firm not only has the time for it but such work is of a nature to be day work rather than premium or bonus work, and also to require almost the entire payment in the form of wages rather than material; as compared with regular production work, therefore, the available resources can be used to carry the organization a longer time, at the same time producing results which will give a big boost to the production business when the demands for that again return.

Reduction of overhead expense is taken for granted but this is a matter of detailed supervision on which we can make no general remarks.

> Now is a good time to build repair parts, units and sub-assemblies. The effect of this on Income Tax reports.
>
> Maintain the organization as it is the most valuable asset which a company possesses. Run the shop part time rather than lay off a lot of good men.
>
> Automotive field must have more efficient equipment to lower production costs. This means much new machinery in automobile shops.
>
> Maintain wages and reduce costs by securing greater cooperation in the organization.

The Automotive Field Outlook

It is our opinion that the automotive industry has reached the limit of its expansion and has, perhaps, even gone a little beyond that limit. This does not, however, in any way set bounds to the amount of business that we will get from this field in the future, inasmuch as our knowledge of it makes us very strongly of the belief that the renewal of old machine tools and the replacing of obsolete machines and methods will require fully as much expenditure as has gone into the expansion of the business in the past. The field will not be as lucrative a one as in the past for builders of standard machinery like lathes, drill presses, etc.; and for the makers of more special types of machinery it will mean a keener and more intelligent competition, but we are prepared to meet that competition and expect to get, if anything, an even larger share of the business than we have gotten in the past, although it will require more effort to get it.

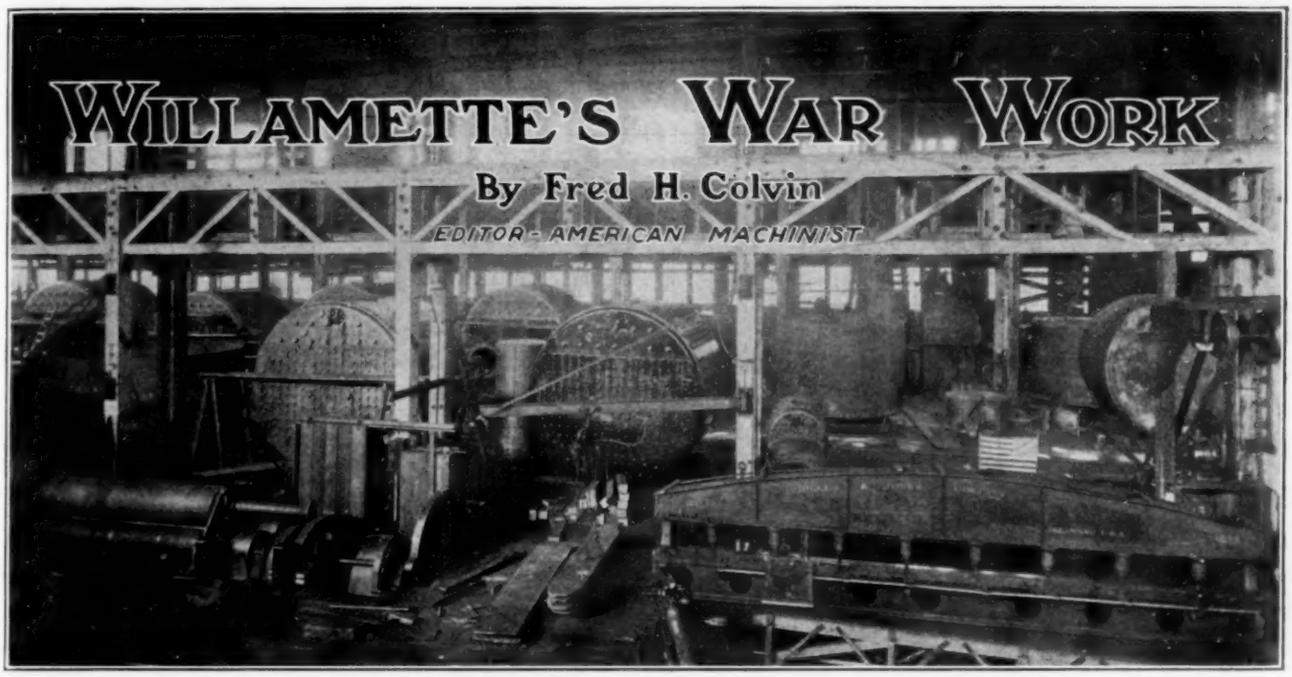
We are still looking for further expansion in the truck fields, although this may be affected by absorbing some of the excess automotive capacities. We are still more hopefully looking to the development of the tractor, either in the immediate or more remote future, to be the next industry to undergo a rapid and large expansion. This, however, is consequent on the solution of the fuel problem. That it will be solved in some satisfactory way is to be expected but just what the solution will be is not yet apparent, at least not to us. Railroads, at the best, while important in many fields, cannot take the place for us of the automobile and other heavy production industries. There is much new work to be obtained in minor and miscellaneous industries, particularly in the textile and electrical fields as well as in all sorts of special machinery. All these have been neglected in the past in favor of the easily obtained order from the automobile manufacturers, but intensive and continuous work in combing out the possibilities of these new fields should produce good results.

Maintaining Wages—Securing Co-operation

We have no immediate expectation and do not think it will be necessary in the future to reduce wages. The machinist has been poorly paid as compared with some of the organized industries and we believe he should not suffer because of the fact that he is unorganized.

In looking over our own works, we are sure that with the intelligent co-operation of the workman and by the exercise of the same engineering skill and operating ability that we have put into the work of our customers, we can so develop the processes in our own shop that we will be able to continue our present rather high rate of wages and at the same time have a margin left, which will later on permit of a reduction—if that becomes necessary.

We are at present running four days a week, eight hours a day, and with full force. The office and drafting rooms are running the regular six days or 48 hours a week.



WILLAMETTE'S WAR WORK

By Fred H. Colvin
EDITOR - AMERICAN MACHINIST

FEW of those who have not visited the Pacific Coast during the past two years can appreciate the great contributions which this section of the country made to the requirements of the Emergency Fleet Corporation. One of the shining examples is to be found in Portland, Ore., in the shops of the Willamette Iron and Steel Works, the mainspring being President Bert C. Ball, and a corps of able assistants. When it came to the building of marine boilers this company covered itself with glory, averaging 22 boilers per month on one rush contract, including February, 1918, when it completed 23 boilers, or one for every work day. Nor were these small boilers, as can be seen from the headpiece, and also Fig. 6. They were 15 ft. in diameter, 11 ft. 6 in. long, of the Scotch type and had three furnaces. The shells were 1⅛ in. thick, which made a problem in boiler construction that could only be handled by good machine equipment and skilled executives and men. One of the interesting methods which contributed to this result is that devised for the drilling of the plates as shown in Fig. 1. Plate drilling by usual methods is a comparatively slow process and in order to drill these heavy boiler plates satisfactorily and in good time, the arrangement shown was laid out and put into operation. Along one bay of the shop the substantially supported track with a gage wide enough to allow the widest plate to lie in between the rails was built as shown at *A* and *B*. Then the four-wheeled trucks as shown at *C* and *D* were built, each

Unless one is familiar with the capacities and the products of some of the larger shops of the Northwest, it is impossible to realize what was accomplished by them in carrying out the war program. Although the Willamette shop had turned out large marine repair work, it required the war demand for large marine boilers to give it the opportunity to show what could really be accomplished by a wide awake management and crew.

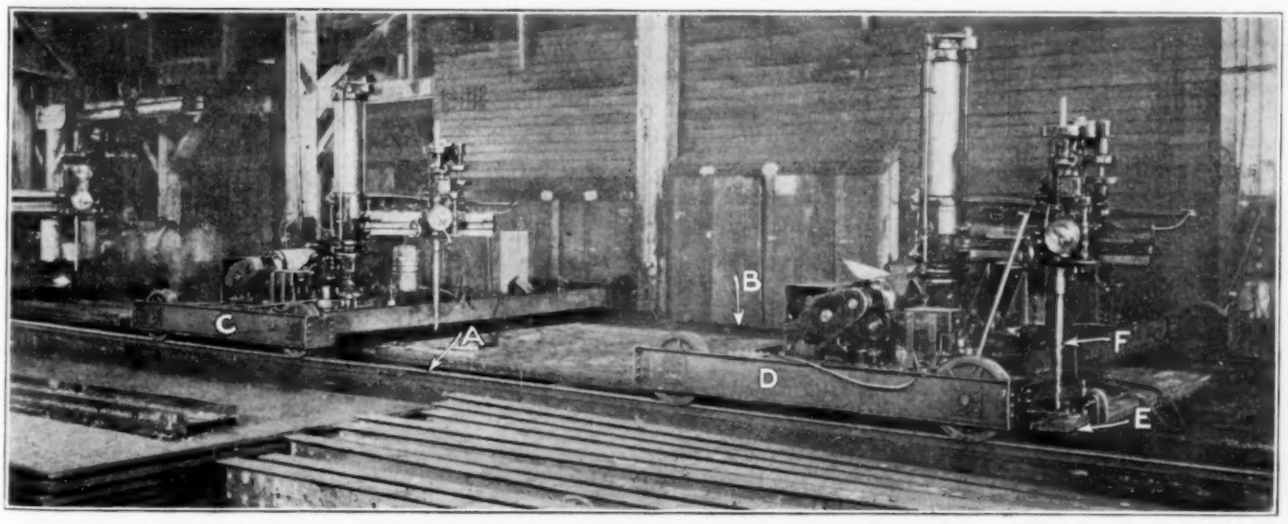


FIG. 1. PORTABLE RADIAL DRILLING MACHINES FOR BOILER PLATES

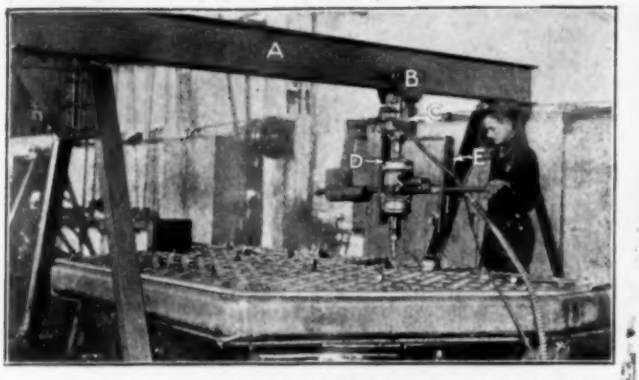


FIG. 2. A LARGE "OLD MAN" FOR AIR DRILLS

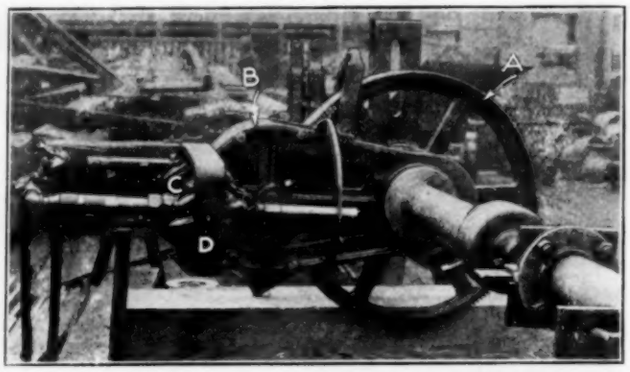


FIG. 3. BORING BAR FOR PROPELLER-SHAFT TUBES

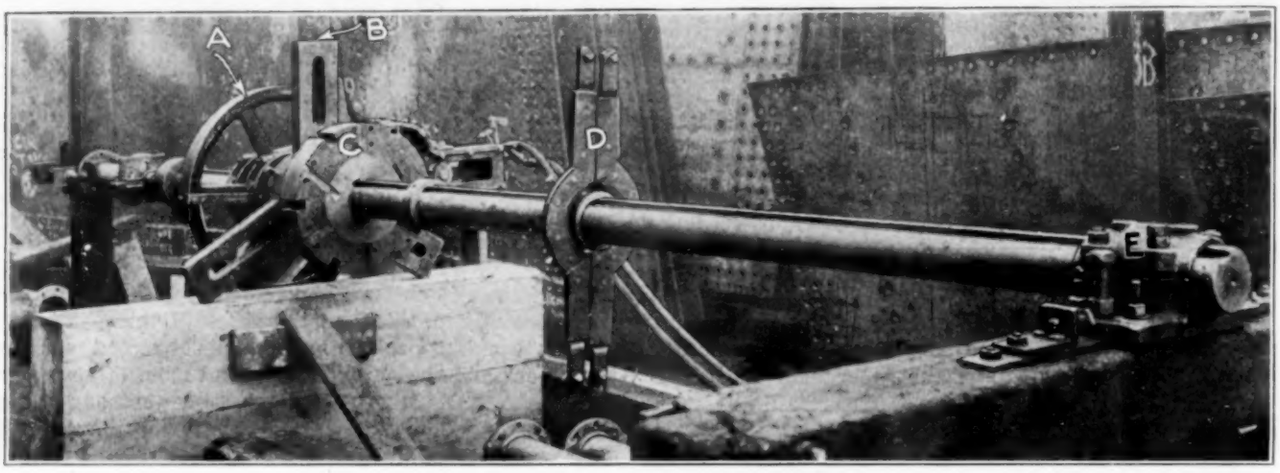


FIG. 4. DETAILS OF THE DRIVING MECHANISM

truck carrying a large radial drill, the two shown in this view being of the "American" type. These drilling machines were so placed on the trucks that the columns were approximately at one-third of the length of the truck, instead of being in the center. By doing this a shorter and stiffer arm could be used, and, when it becomes necessary to reach the other end of the long sheet, a crane picked up the whole truck and turned it end for end. By having some turned one way and some the other all parts of the sheet could be readily reached.

The sheets were laid out in the usual manner, clamped together as shown at *E* and by the use of extension drill spindles or sockets, as at *F*, the work of drilling was rapidly and easily handled.

Another drilling device which helped materially to increase the output of boilers is shown in Fig. 2, this de-

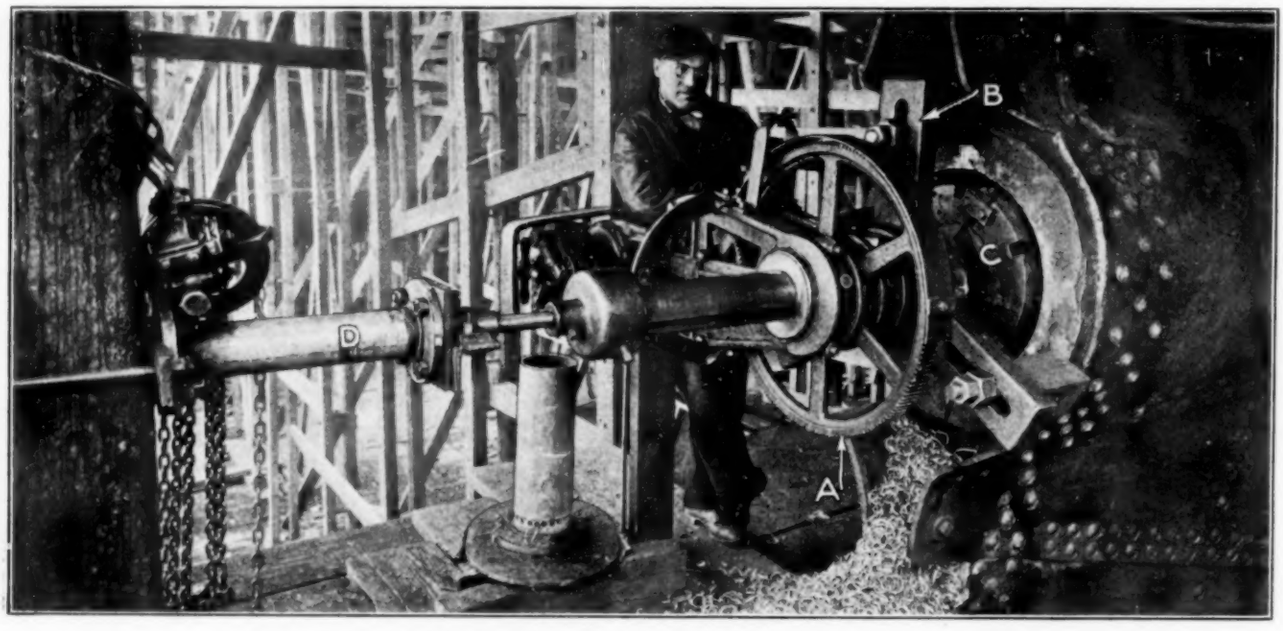


FIG. 5. THE BORING BAR AT WORK

vice being a sort of glorified "old man" and was used in connection with an air drill for drilling tube plates of water headers and similar work. This device is also mounted on truck wheels and moves along a track to any desired position over the work, which is supported on horses so as to be at a convenient height for the operator. The heavy I-beam *A* which forms the top of the crane not only acts as a support but also as a runway for the small trolley *B* which carries the air motor. The rest of the framework is composed of angles and flat plates, as can be seen. The motor hangs from the small truck and receives air through the head *C*. From this head hang the two arms *D* and *E*, which carry the air drill loosely, supporting it while being moved from one position to another. This arrangement makes a very convenient way of drilling small holes in work which for any reason it is not advisable to put under the larger drilling machines.

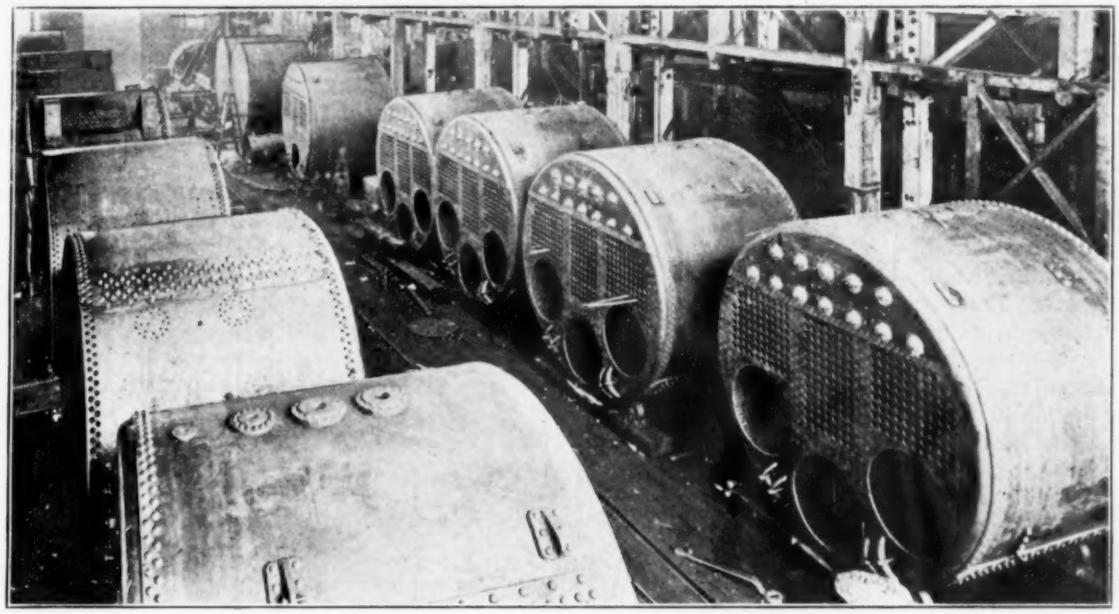


FIG. 6. THE ASSEMBLING BAY IN THE BOILER SHOP

Boring Ship Stern Tubes

An entirely different type of work is illustrated in Figs. 3, 4 and 5, these showing a special boring bar which was designed and built for boring shaft tubes after they are in place in the vessels. The boring bar itself is shown in Fig. 3. This view also shows the driving gear *A*, the three pronged supporting spider *B*, the toolhead *C*, and inner support at *D*, and an end bearing at *E*. Further details, together with the way in which the bar is used, are shown in Figs. 4 and 5.

In Fig. 4 are the details of the driving mechanism, consisting of the large driving gear *A*, suitable reduction gearing in the housing *B* and the motive power *C* in the shape of an air drill, which is mounted in the frame *D* in order to hold it in proper relation to the gear reduction.

In Fig. 5 we have the boring bar set up and in operation, the gear *A*, spider *B* and toolhead *C* being lettered to correspond with the other illustration of the bar. This shows the reduction gearing as well as the motor and its supporting frame. In addition it shows the thrust mechanism *D*.

The shape of the chips shown below the stern tube indicates what sort of a cut is being taken by the boring tool, and it is interesting to note that this device proved entirely satisfactory both as to time and quality of the work done.

A general view of the type of boiler referred to in the first part of the article, together with the use of rollers for mounting them, shows that they could be readily turned for various operations as shown in Fig. 6. One of these boilers for each working day is an extremely large output for a plant of this size.

Help-Wanted Advertisements

By A. W. Forbes

The article by H. M. Fitz on page 1199, Vol. 53, of *American Machinist*, gives some interesting criticisms of want ads and states why they do not bring the desired results, but fails to say how they can be written to appeal to the desired class of applicants.

The advertisement that showed me the difficulties of giving the proper appeal was a 215-word display advertisement in a newspaper. It stated age required, line of advancement open, nature of the work, qualifications required and some details as to how I should test the applicant to determine those qualifications. The only blind part was my name and address. This advertisement would certainly meet all of Mr. Fitz's suggestions.

A good number of replies was received, but every one gave the impression that the applicant had not read the advertisement. Not one was worth considering. Since that date I have used a simpler form of advertisement something like the following: "Young man wanted. Must know something about electricity." It is much cheaper and seems to be just as good, but that isn't saying much.

I feel that the real trouble is that the applicants do not know anything about their own ability or lack of it. Few men seem to realize that is is possible to operate a machine for years without knowing anything about it, or that they can wire a house without knowing anything about electricity.

Continuous Milling of Pump Bodies

High Production Rate Obtained by Using Continuous Process—Table Revolves to Feed the Work—Castings Replaced While Machine Is Cutting

BY SPECIAL CORRESPONDENCE

THE idea of continuous machining has been given considerable attention, although only in recent years has the principle become generally recognized. When a number of parts of the same kind require milling, continuous milling machines have proved effective. The Goulds Manufacturing Co., Seneca Falls, N. Y., is using a continuous milling machine to finish some of the parts of small high-speed pumps which it manufactures. The nature of the surfaces to be machined is shown in Fig. 1. On the cylinder itself, to be seen at *A*, the two ends and the bearing on the side for the valve box require finishing, while two adjoining sides of the valve box are machined, as can be seen at *B*. All of this work is performed on one machine, by the use of interchangeable fixtures, a rather large lot of the castings being put through the successive operations, so as not to necessitate too frequent changing of fixtures. The machine used was made by the Newton Machine Tool Works, Inc., Philadelphia, Pa., and is designated as the Model C-28 continuous milling machine, described in the *American Machinist*, page 642, Vol. 53.

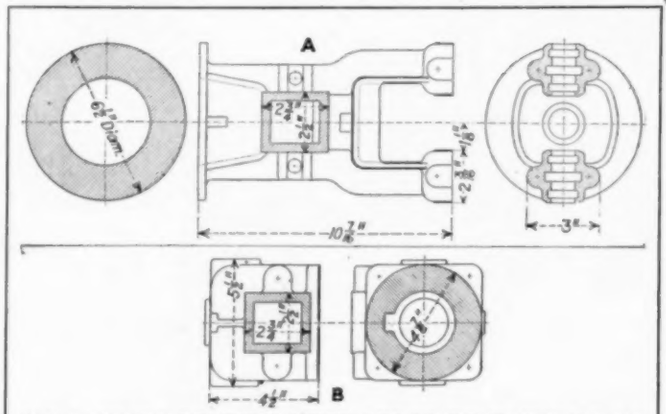


FIG. 1. CHART SHOWING SURFACES TO BE MACHINED ON CYLINDER AND VALVE BOX

In Fig. 2 can be seen the arrangement used when milling the bottoms of the cylinder castings. A rotating fixture holding sixteen castings is employed. The roughing is done by the cutter on the left and the finishing by the one on the right, the depth of cut being $\frac{3}{16}$ in. Both of the face milling cutters are 10 in. in diameter, the cutting tools of the roughing cutter being stellite, and those of the finishing cutter being high-speed steel. The castings are held in place by means of studs and rest upon a ring which fits in the half hole for the journal bearing. The table revolves continuously and the operator removes the finished castings and replaces them with unmachined ones while the tools are cutting. It is stated that a lot of 100 are machined in three hours. The tops of the cylinder castings are machined to provide bearing surfaces for the caps of the journal boxes, see Fig. 3. The same cutters and fixtures are used, the fastening being different.

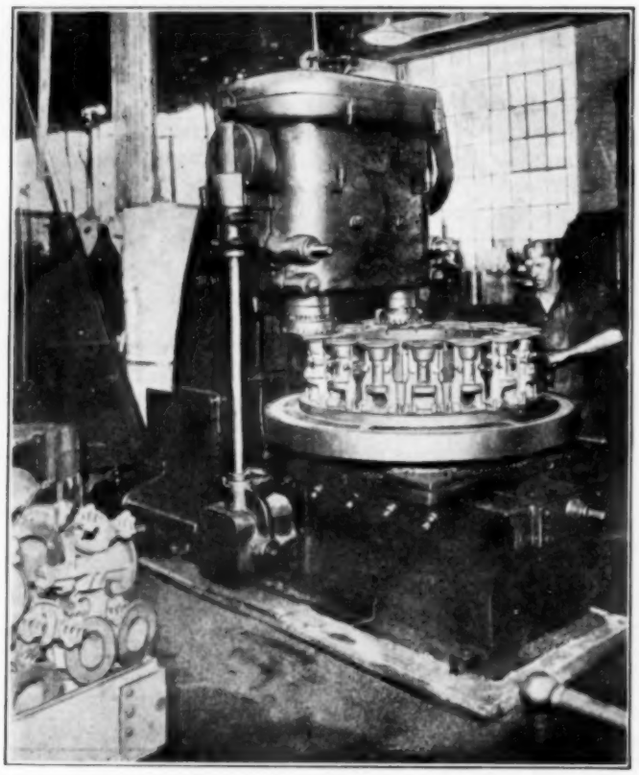


FIG. 2. CONTINUOUS MILLING THE BOTTOMS OF CYLINDERS

FIG. 3. MILLING THE TOPS OF THE CYLINDER CASTINGS

The castings rest directly upon the base of the fixture, and each one is held in place by a clamp secured by a single stud. The production is 100 pieces in three hours.

Milling the Valve-Box Pad

The last of the milling operations on the cylinder is the machining of the side for the valve box, see Fig. 4. A different fixture is used for this work, as well as different cutters. High-speed steel cutters of 4-in. diameter are used, because of the fact that the surface to be machined is not large and is somewhat lower than adjacent parts of the casting which it is not desired to machine. It should be noted that the work is not held rigidly in the fixture, but each piece is practically clamped separately to the large plate on the table. The ring in the center supports the small end of the cylinder, on which a clamp is placed. The large end, also, is held in position by an L-clamp. Ten castings can be placed on the table at once, it being stated that 100 parts can be machined by this method in 4 hours.

Owing to the fact that the machined surfaces are spaced far apart, time is lost by the passing of the cutters from one casting to the next; and it seems that a greater production rate could be obtained by an arrangement which would bring the surfaces to be machined closer together.

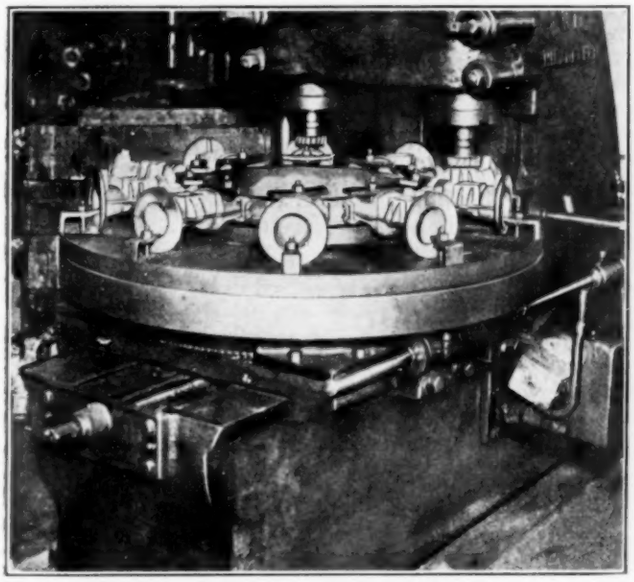


FIG. 4. MACHINING SURFACE FOR VALVE BOX ON CYLINDER

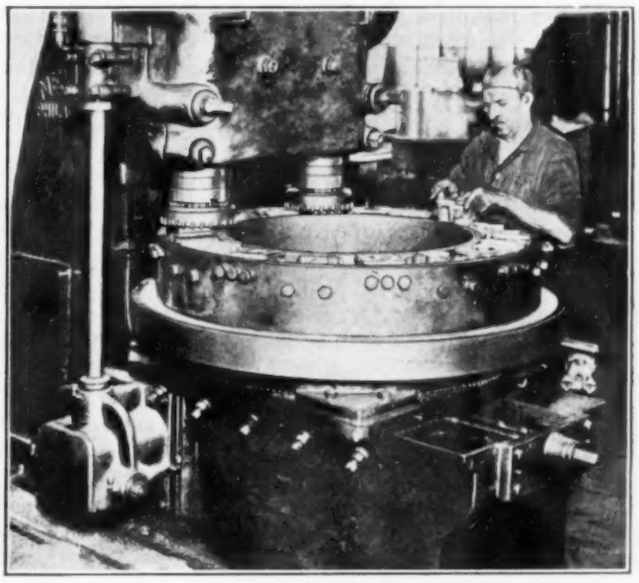


FIG. 5. METHOD OF HOLDING VALVE BOX WHILE MILLING

Method of Holding Valve Box While Milling

To machine the valve box which fits on the side of the cylinder, a different fixture is used, as shown in Fig. 5. The same 10-in. diameter cutters used for the first operations are employed, however. Since it is necessary to machine two sides of each box, the fixture is so made as to hold the boxes in two different positions. One station of the fixture holds the box so that the top can be machined, and the next one so that the side is up. Thus, by merely shifting a box to the next position in the fixture after one surface has been machined, the other side can be finished. Since the fixture holds 18 castings, 9 valve boxes are completely machined at one revolution of the table. A lot of 100 boxes can thus be machined in 4.3 hours, it is stated.

From the illustrations it can be seen that the work is placed on platforms, which can be conveniently moved about the shop. The machine is belt-driven from an overhead shaft. The two spindles have small independent vertical adjustments, so that the cutters can be set at the right height relative to each other. The head carrying the spindles has a vertical adjustment to permit of the cutting of work of different heights. Since it is necessary to change the height of the head frequently, because of the change in the character of the work done, a counterweight has been attached, so as to balance the weight of the head and make the adjustment easy. The weight is inclosed in the cylindrical protector at the rear of the machine, and is fastened to the head by means of the cable to be seen at the tops of Figs. 2 and 3.

The machine is not equipped with quick-change gears in the drive or in the feed, so that the rate of each of these is kept constant throughout the work. The speed of the spindles is 32 r.p.m., which gives a cutting speed of 80 ft. per minute when the 10-in. cutters are being used.

A feed of 7 in. per minute on the maximum diameter was used, the depth of cut being about $\frac{1}{16}$ in. The maker of the machine states that the speed of the roughing cutter should be increased to 100 ft. per minute, and a feed of 15 in. per minute be employed.

Satisfactory Results Obtained

Despite the fact that the machine did not seem to be pushed, the user claims that by the system just outlined very satisfactory results have been obtained. The three surfaces to be machined on the cylinder were formerly milled simultaneously on a three-spindle machine. It was stated that the method here described enables the production of the part in half the time formerly required, despite the time now needed for changing the fixtures.

It seems that the principal loss of time formerly occurred in the replacing of the work, which action is now performed while the machine is cutting.

Is This a Punch Press Job?

BY G. R. RICHARDS

In response to a request by Mr. Hudson, printed on page 267, vol. 52 of *American Machinist*, for information upon the subject of producing flats upon small round rods, several suggestions have appeared in the columns of that journal; the suggested methods including milling, broaching, rolling, and shaving.

All of these methods leave something to be desired. The main difficulty with any method of cutting is to hold the work firmly enough to resist the tendency of the rod to turn over, and yet avoid marring or springing it with the clamps. A further difficulty is presented by the burr that naturally results from any of the above methods, inasmuch as this burr involves a second handling to remove it, and, if the work is carelessly done, the finish may be spoiled.

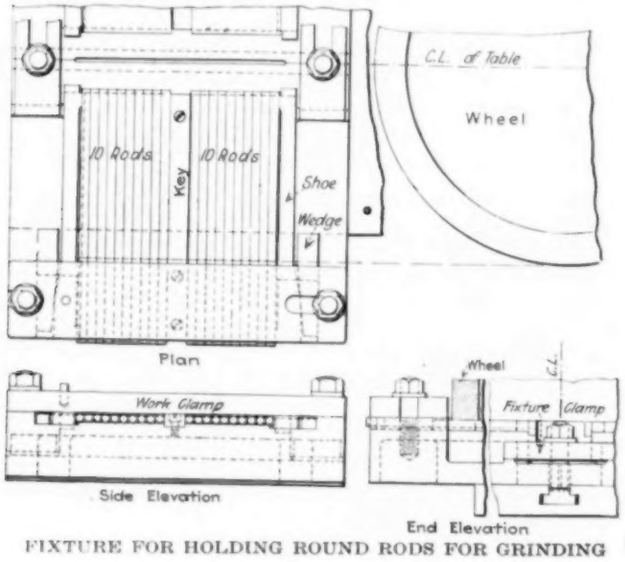
There is another method that has not thus far been mentioned, and that is grinding. The machine I would suggest is a vertical-spindle surface grinding machine with a large ring wheel and a reciprocating table. Such machines are made by several manufacturers and are in common use in the larger shops.

A sketch of a holding fixture is presented herewith. A number of small units is suggested instead of one large fixture, both to save in cost of pattern and machine work and to make them more convenient for handling. This method also permits the use of extra fixtures which can be loaded while the tableful of rods is being ground. The cost of the extra fixtures is small compared with the time saved, as these machines work so fast that the loading time on a job of this kind would practically equal the machining time.

To load, place the rods and shoes in the fixture with the wedges and clamping bar removed. Then slip on the work clamping bar, stand the fixture on end to line up the rods endways and bring up the work clamping bar nuts lightly. Then drive home the wedges and set up the work clamping bar nuts tight. The spacing of the fixture is to suit the diameter of wheel.

The work clamping bar and shoes above mentioned should be of tool steel—spring tempered, and slightly bowed, so that the ends are higher than the middle. Then, when tightened, the middle bearing will always seat on the work.

Allowing ten minutes for grinding and loading a tableful—120 pieces—would give a production of 720 an hour, not allowing for lost time.

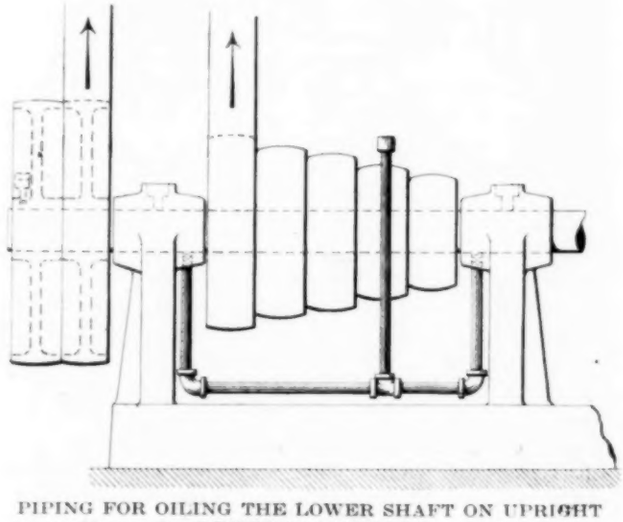


FIXTURE FOR HOLDING ROUND RODS FOR GRINDING

Oiling the Lower Shaft on Upright Drilling Machines

BY W. BURR BENNETT

Our machine-tool equipment included a number of the so-called standard 20-in. upright drilling machines. The belt drive pulls up toward the line shaft as does the belt on the cone pulleys, putting the total pull on



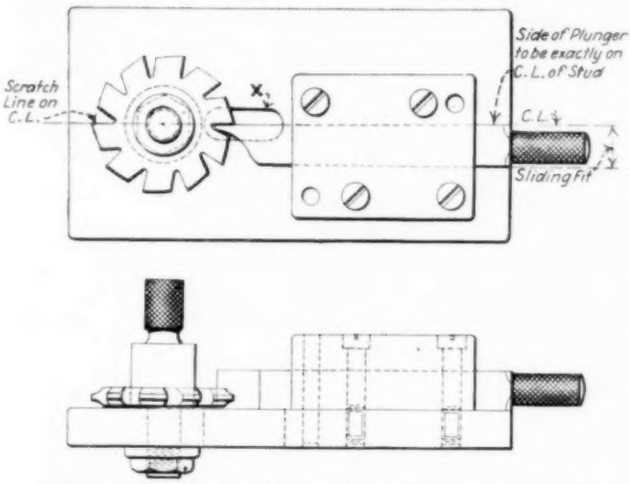
PIPING FOR OILING THE LOWER SHAFT ON UPRIGHT DRILLING MACHINE

the lower shaft upward and in proportion to the tension on the belts. Both bearings, as shown in the sketch, were provided with oil holes and cup-shaped recesses to hold oily waste. Allowing for the fact that these machines were being loaded away beyond their capacity, we were at a loss to account for the too frequent babbitting on these bearings. Naturally we were not interested in replacing bearings all the time so we proceeded to make a little study of conditions. An analysis showed that the upward shaft pressure was causing the oil to pump out of the so-called oil hole in the top half of the bearing. In other words, our oil hole was directly in line with the resultant bearing pressure and was worse than useless. In fact the bearings would probably have stood up better with a grease cup that would force the grease down into them. As a remedy we plugged these oil holes up, tapped the bottom of each bearing for ⅛ in. pipe and arranged a piping system as shown, with a long vertical filler pipe fitted with a cap. This arrangement completely solved the problem, allowing the oil to feed from underneath as it should and also keeping a little head on the oil. It cost about $8 per machine to apply, and has saved $80 worth of bearings so far.

Grinding Gage for Gear Cutters

By E. A. Dixie

The importance of properly ground gear cutters does not seem to be appreciated as it should be. Even new cutters of standard makes, when checked up recently



FIXTURE FOR GAGING THE ACCURACY OF GEAR CUTTER TEETH

before putting them in service, were found to have teeth which had not been sharpened radially. Cutters which had been sharpened in the shop were mostly found to have been ground with a "hook" evidently with the idea that they would cut freer, no doubt they would on the general run of materials but at the expense of tooth form in the finished gears. It was just this feature of incorrectly formed teeth which forced us to devise some simple fixture for checking up the quality of the work of the cutter sharpener.

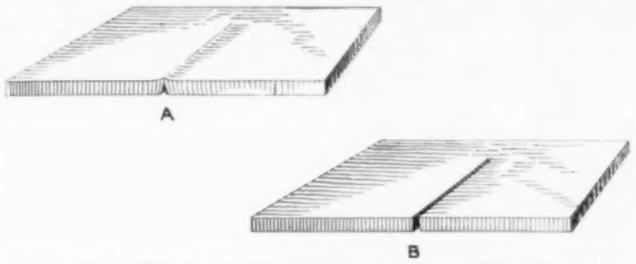
The fixture shown in the illustration is mounted on a box about 12 in. long by 10 in. wide and about 8 in. deep. The top of the box is plain wood except for a small window of ground glass which is let in as shown by the oval *X* in the plan view. Inside the box there is an electric light. With a cutter in place on the stud the plunger is slid forward into one of the gashes and the cutting face of the tooth brought to bear on the face of the plunger. As the plunger face is in accurate alignment with the center of the stud any error in grinding will be at once apparent against the illuminated ground glass background.

Cutting Fine Slits in Sheet Metal

By E. Lytton Brooks

Helensburg, Dumbartonshire, Scotland

A few years ago it so happened that I had some very fine slits to cut in mild steel and brass plates ranging in thickness from ⅛ to ¼ in., and as this job has



EXAGGERATED SECTIONAL VIEWS OF RAISED PORTION AND OF THE FINISHED PIECE

cropped up again quite recently I think the proposition may be of interest.

Although this method, being so simple, is probably known and practiced by some; at the time I required such knowledge no one seemed able to help me out, and not a few considered it impossible. I solved the problem by experiments, and now hope to save others the trouble. The slits referred to, varied in width from 0.0005 in. to 0.001 in. and in length from 0.210 in. to 1 in.

In the first place it becomes necessary to have some means of measuring the width of the slits as accurately as possible. This was accomplished with feeler, or thickness, gages rolled, and afterwards further thinned down, from steel tape. The method employed was as follows: The steel ribbon was carefully rolled from 0.005 in. to 0.002 in. in a pair of close and even fitting rollers. The latter dimension being reached, our rollers refused to reduce it further. A boxwood cylinder was then turned, coated with fine emery powder, and run at a speed of 5,000 r.p.m.; the steel ribbon being lightly drawn over the cylinder until the micrometer gave the correct reading over at least a 1-in. length. The piece required was cut out and used as the gage.

Next a finely pointed blade was made from a piece of ¼-in. drill rod; similar to a pocket knife blade, only thinned more at its extremity. This was carefully tempered and inserted in a file handle of suitable size.

With the plate to be cut laid flat on a piece of faced hardwood, (the position of slit having previously been marked out) the blade is drawn with even pressure against a straight edge until it has sunk deep enough in the metal to follow the groove. Laying aside the straight edge the groove is deepened by continuing to pass the blade over it until a faint, slightly raised line shows on the under face. The illustration at *A* gives a magnified impression of the work at this stage.

The raised line is now lightly and evenly rubbed with a stick of rotten-stone or fine carborundum until it is flat, or nearly so. It must not be rubbed through, but should leave a film of metal still unbroken.

A small sharp piece of the prepared steel ribbon,

(using the correct thickness) inserted in something which allows of its being handled easily, is used to cut through the remaining film. The steel ribbon is gradually worked through, and from one end of the groove to the other, until the slit is of the correct length. If the face of the plate from which the groove was started is cleaned off flat with emery paper, say a French No. 1, it makes a very neat job. Also a slight dust with a No. 00 paper on the slit side removes the bur, but it must not be worked hard enough to open the slit. All that remains to be done is to rinse in petrol which removes the metal dust sticking in the slit.

The reader will note that the correct width of slit is only on one side of the plate as at *B* in the illustration, but nine times out of ten this is of no importance. The usefulness of this method is appreciable because it does not entail any expensive apparatus and is simple; also lengthy practice is not required to become fairly proficient.

Laying Out a Circular Arc When Center Is Unknown or Unavailable

By William S. Ayars

Having recently had occasion to lay out a circular arc when it was impossible to get a center and when as a matter of fact the radius was not known, I looked in several handbooks for a rule. In one book the following formula was given, the letters referring to Fig. 1:

$$y = \frac{x^2}{L^2}h.$$

Now this can be written $y = \left(\frac{h}{L^2}\right)x^2$ in which $\frac{h}{L^2}$ is a constant and can be called a.

Then the equation takes the form $y = ax^2$ (1)

which is the equation, not of a circle, but of a parabola, as can readily be proved, either by analytic geometry or by laying out a number of points and noting the shape of the curve. But in the case of a large value for L and a small one for h (as in the case of a deck-beam) the difference is not worth noting; in fact, the parabola may be the better curve. The only object of this curved deck-beam is to make a "crown" so as to shed water, for structurally a straight beam is better as there is then no thrust outwards against frames when carrying a deck load.

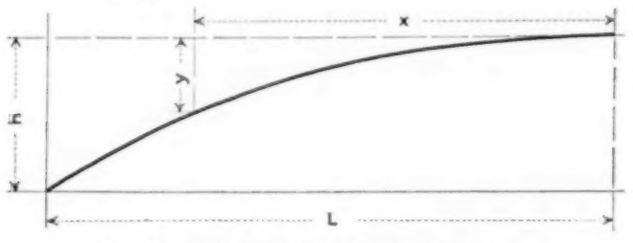


FIG. 1. REFERENCE FOR FORMULA (1)

But there are occasions when the actual arc of a circle is required and it can be laid out as follows:

Referring to Fig. 2, let AX and AY be axes and AB the arc of a circle, with center at O, on AX.

Let P be any point and its ordinates x and y. Now PEO is a right triangle and $\overline{PE}^2 + \overline{EO}^2 = \overline{OP}^2$.

But $PE = y$; $EO = R - x$; and $OP = R$. So we can write the equation

$$y + (R - x)^2 = R^2$$

or

$$y^2 + R^2 - 2Rx + x^2 = R^2$$

which reduces to $x^2 + y^2 = 2Rx$. (2)

By the same reasoning,

$$L^2 + h^2 = 2Rh \quad (3)$$

To apply this to the usual case we are given only h and L. In other words, we are required to lay out a circular arc having given the chord (or half-chord) and the versed sine, or rise, or amount of camber. We do not know what the radius is and, if we did, the chances are that in the usual shop we would have no proper means of striking

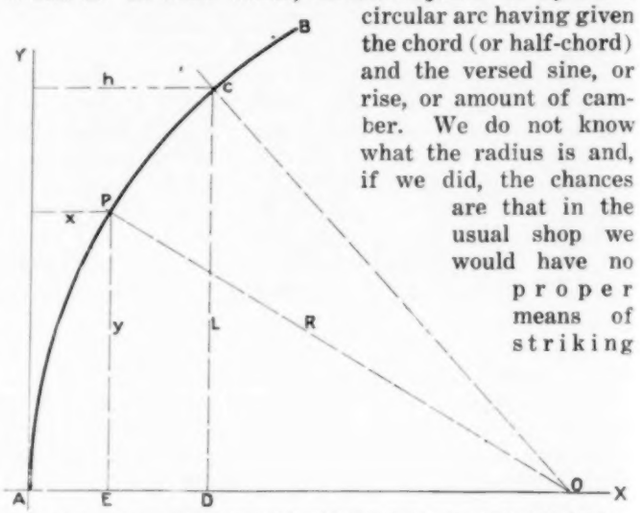


FIG. 2. REFERENCE FOR FORMULAS (2) TO (8) INC.

the arc. If the radius is wanted, it can easily be found from equation (3), for if $L^2 + h^2 = 2Rh$

Then

$$R = \frac{L^2 + h^2}{2h} \quad (4)$$

To solve the problem as usually required, given L (or $2L$) and h, take equation (2) and substitute for R the value as deducted above in (4). Then

$$x^2 + y^2 = 2\left(\frac{L^2 + h^2}{2h}\right)x \quad (5)$$

This may be written

$$x^2 - 2\left(\frac{L^2 + h^2}{2h}\right)x = -y^2 \quad (6)$$

which has the form of an ordinary quadratic. Completing the square,

$$x^2 - 2\left(\frac{L^2 + h^2}{2h}\right)x + \left(\frac{L^2 + h^2}{2h}\right)^2 = \left(\frac{L^2 + h^2}{2h}\right) - y^2.$$

Extracting the square root of both sides

$$x - \frac{L^2 + h^2}{2h} = \pm\sqrt{\left(\frac{L^2 + h^2}{2h}\right)^2 - y^2}$$

$$x = \frac{L^2 + h^2}{2h} \pm \sqrt{\left(\frac{L^2 + h^2}{2h}\right) - y^2} \quad (7)$$

Now equation (7) *looks* harder than it is; by assigning arbitrary values to y, and L and h being already known, it is very easy to get corresponding values for x. Let us assume an arc with a chord length of 12 ft. and a versed sine or height of 2 ft. Then $L = 6$ ft. and h = 2 ft., $\frac{L^2 + h^2}{2h} = \frac{36 + 4}{4} = 10$.

Letting $y = 5$, $x = 10 \pm\sqrt{100 - 25} = 10 \pm\sqrt{75}$ $= 10 \pm 8.66 = 18.66$ or 1.34. While the $\pm$ sign is used, it is only the $-$ sign that we need, as the $+$ sign gives the ordinates for the other side of the circle. Hence for $y = 5$, $x = 1.34$.

When

$y = 4$, $x = 0.835$
$y = 3$, $x = 0.461$
$y = 2$, $x = 0.202$
$y = 1$, $x = 0.050$

It is, of course, obvious that the quantity $\frac{L^2 + h^2}{2h}$ is th

radius of the arc, and if the radius is given it can be used, the equation then becoming

$$x = R - \sqrt{R^2 - y^2} \qquad (8)$$

which looks much simpler. But as the problem usually comes to the layer-out giving only the chord and its "rise," the form in (7) is easier to apply. No special mathematical knowledge is required beyond the ability to read a formula, as the square roots needed can be found in any handbook if the man in question cannot work them out for himself, and even if he can, the time saved and accuracy gained in using a handbook makes that method preferable.

A comparison of values worked out by the formula $y = \frac{x}{L^2} h$ (referring to Fig. 1) and formula (7) shows the differences, after this formula is written

$$x = \frac{y^2}{L^2} h$$

to make it correspond with the axes as in Fig. 2. This comparison is given in the following table:

COMPARISON OF VALUES OBTAINED BY DIFFERING FORMULAS

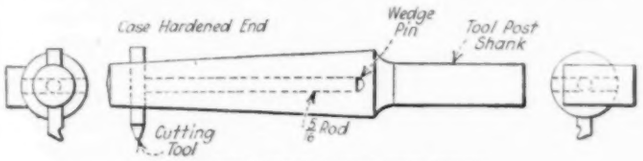
Assigned Values of y	Values of x in $x = y^2/L^2 \times h$ Ft.	Values of x in Formula (7) Ft.	Difference
5	1.39	1.34	0.05′ = 0.06″
4	0.89	0.835	0.045′ = 0.54″
3	0.50	0.461	0.039′ = 0.468″
2	0.222	0.202	0.02′ = 0.24″
1	0.0555	0.0505	0.005′ = 0.06″

From these results it can be seen that for an accurate arc of a circle the first formula would be quite a bit out, but for merely a smooth curve it is quite good enough, especially when L is large compared to h.

A Boring Bar of Merit

BY E. LYTTON BROOKS
Helensburgh, Dumbartonshire, Scotland

Referring to an article under the above title, with sketch, by John Houssman, on page 278 of *American Machinist*, I am afraid there is one point on which I



MR. HOUSSMAN'S BORING TOOL

am not quite clear. Mr. Houssman points out that small bottom clearance is required when boring blind holes.

First of all I may not quite understand what he means by a "blind hole." If he means one that is bored out and squared up, or bottomed at the blind end, I don't see how it can be done with his tool. I am from Missouri this time. As the end of the bar holding the tool projects beyond the tool itself at the leading end, and as his sketch does not show the tool inclined, but at right angles to the bar, how is it accomplished?

I have attempted a plan of this bar in rough sketch which illustrates my point. With the exception that a hole cannot be finished out on the bottom it looks to be quite a good tool. But don't let me catch a turner using a machine spanner to knock the pin in, out, or, for that matter, anything else except nut and bolt manipulation; that's all.

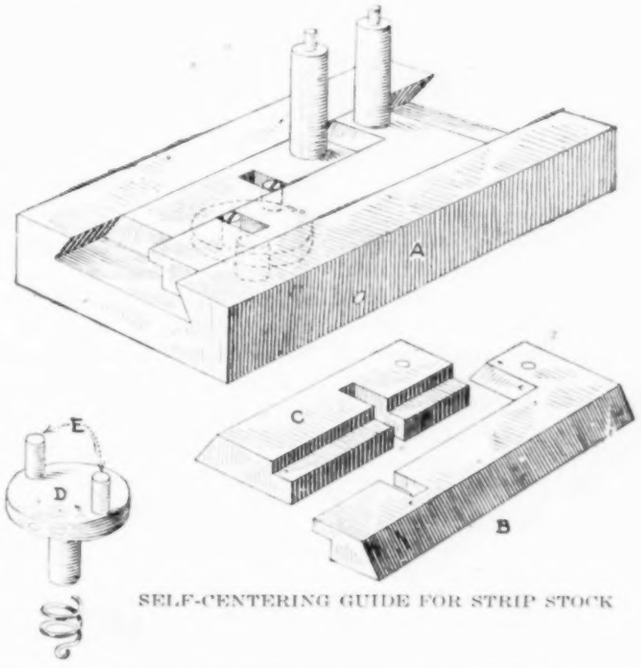
A Self-Centering Guide

BY R. H. KASPER

A common source of trouble, when punching a cheap grade of stock in an automatic punch press, is the fact that the stock often varies in width, making it necessary frequently to center the stock under the punch. To overcome this difficulty, the guide, shown in the sketch, was designed.

This guide, after the initial adjustment, always carries the stock central under the punch, regardless of any variation in width, because of the fact that neither of the rolls can move in either direction without a corresponding movement of the other roll in the opposite direction.

The guide consists of an outer case *A*, which carries two sliding members *B* and *C*. These sliding members are each slotted to receive a pin carried on the disk *D*. These pins are placed equally distant from the center of *D*, which fits freely in a recess counterbored in the bottom of case *A*. A helical torsion spring provides the necessary tension to keep the rolls in contact with the stock at all times. As will be seen by the sketch, the sliding members *B* and *C* are constructed with dove-



SELF-CENTERING GUIDE FOR STRIP STOCK

tailed edges so that it is unnecessary to provide a retaining plate or other means to keep them in the outer case.

When assembling the guide, the disk *D*, with its spring, is placed in position first, and after attaching the spring, is given a few turns to tighten the latter. A pin is inserted through the hole in the outer case and into the hole in the disk, serving to prevent the spring from unwinding while the guide is being assembled. *B* and *C* are then slipped in from the end and the small pins *E* inserted in the disk, after which the pin in the outer case may be withdrawn. The slots in *B* and *C* should be so placed that when a piece of stock of the average width is placed between the rolls, the slots will coincide. This will permit the same motion of the rolls, both above and below the average width and at the same time keep the stock in a central position.

IN THIS ISSUE

WE WILL best introduce the first of Fred Colvin's group of articles on "The Foreman and His Job," which is the first in this issue, by quoting from it: "The foreman's duties are many and they vary according to the system under which the shop is run. Both the foreman and the management, however, should thoroughly understand and appreciate that the foreman represents the firm to the men. He has the most intimate contacts and can do much to make or mar the good feeling that must exist if hearty co-operation is to be secured."

About 1906 Herman Schneider, at present Dean of the Engineering College, University of Cincinnati, started the word "co-operative" on its way to fame in educational matters by getting under way his now famous co-operative engineering course. Since that time many universities and public high schools have seen the light and have instituted similar courses of education. Among them is the course of the high school of Lansing, Mich., told about by E. M. Hall, Lansing's director of vocational education, on page 83. Mr. Hall confines his article to facts and photographs, both of which make for easy and profitable reading. Incidentally, the photos show that the course has attracted a bunch of fine looking boys.

De Leeuw's treatises on metal cutting tools become more and more absorbing the further they go. This week he introduces "feed" showing that it adds to the complexity of design problems and that it must be given a proper amount of consideration. Round-nosed, square-nosed, diamond point and several other types of tools are treated and toolholders come in for a share of discussion.

A rather unusual article is that by John T. Bartlett on "Correspondence Supervision," page 94. There is no doubt that on the average certain effects on the recipient are produced by given types of letters, and that many correspondents have much room for improvement of their understanding of how to write a letter to accomplish a particular result. Says the author, "The kind of letters we write has a great deal to do with the volume of business we secure. Poor letters lose customers. Good letters hold customers and turn them into permanent friends of the house." Are needed betterments in business letter writing to be brought about by correspondence supervision?

A railroad article by J. V. Hunter, page 97, deals with an apprentice school, a school different because attendance of the apprentice is compulsory and because he is assessed a fixed sum per month to apply against current expenses. An old coach furnishes the class-room. The boys attending such a school ought to feel as though they were getting somewhere.

To use a word not elegant but expressive, it is no cinch to properly distribute overhead to departments. This week's installment of "Modern Production Methods" (W. R. Basset), page 99, takes up the departmentalizing of overhead expenses. We shall not attempt to point out the high spots of this article, believing that the subject and the author will sell it to those of our readers who keep in touch with this page.

On page 104 we have an article "Meeting the Present Emergency." We believe you will agree with us that it is correct to call present conditions of deflation and readjustment an emergency. We do not know, of course, how long our emergency conditions are going to last. But we do know that how we meet the emergency is all-important. What one eastern machine-tool concern is doing is told on page 104 by the manager. It is building spare parts, units and subassemblies, making every effort to maintain organization and wages, and at the same time doing all possible to reduce costs. We are open to receive statements and suggestions from other managers and executives. Dissemination of such information cannot but help the industry at large. May we not have your help?

We have a tendency, and a very good one it is, to forget the war—all but the lessons it taught. There was so much, however, in the way of development and accomplishment that a great deal of it remains to be told. Among Fred Colvin's Pacific coast articles we found one along the lines mentioned—Willamette's War Work—page 105. The Willamette plant built boilers for the Emergency Fleet Corporation and built them well and quickly, says Colvin. He then goes on to tell how a wide-awake management and crew got results.

Coming Features

Next week will usher in the series on magnetic chucks by Ellsworth Sheldon. Any comprehensive series such as this almost invariably devotes the first part to origin, history and elementary construction, which should not be missed if the following parts are to be fully understood. It is so with Sheldon's series, his initial article dealing with original development and construction.

Fred Colvin's "Building Motors on the Pacific Coast" will be continued in the next issue. The machining of the connecting rod and its assembly with the piston are the chief subjects treated. There will be another motor article, "Casting and Machining Oil Engine Pistons, Piston Rings and Cylinders," by Samuel Rosswell.

It is not the intention to name all of the major articles for coming weeks in these paragraphs. We want to let you in on two or three more, though. Chesla Sherlock writes on "Arbitration," I. William Chubb, one of our European editors, presents notes on improvement in British machines, and there is quite an article by a special correspondent on the locomotive repair shops of the B. & O., at Glenwood, Pa. All will appear next week.

EDITORIALS

National Thrift Week—A Timely Event This Year

THIS week is the National Thrift Week of the economic program of the Young Men's Christian Association. It has particular significance for every one connected with the machine industry this year. We are all suffering the consequences of the wild inflation of last year and as a result we should all be unusually receptive to preachings of thrift, no matter what their source.

The manufacturer is facing the serious losses involved in idle plants, heavy taxes based on the previous year's business and shrunken inventories. The merchant is up against the problem of selling on a falling market, goods bought when prices were high. The workman is on part time or laid off altogether and is undoubtedly in the worst position of all. The condition is only temporary, fortunately, but not much easier to endure even so. It is like a toothache. You know it can be stopped as soon as you can get to the dentist, but that doesn't make it hurt any the less.

The careful men in any walk of life have practiced a thrift that will see them through the present depression and put them in an advantageous position when business picks up. Their example should stimulate the improvident citizen in his present sad state to turn over a new leaf and make provision for the future when he begins to get on his feet.

The Ten Financial Commandments laid down by the Y. M. C. A. are well worthy of adoption by any citizen of this country and we recommend them unreservedly. They are so well stated that they might well have come from the pen of the patron saint of thrift, Benjamin Franklin, an anniversary of whose birthday came on Monday, the seventeenth of January, the opening day of National Thrift Week. The Commandments urge everyone, and particularly the workman, to:

1. Work and Earn.
2. Make a Budget.
3. Record Expenditures.
4. Have a Bank Account.
5. Carry Life Insurance.
6. Own Your Own Home.
7. Make a Will.
8. Pay Your Bills Promptly.
9. Invest in Reliable Securities.
10. Share with Others.

A sermon could be preached or an editorial written on each one of the ten. For the individual it is difficult to single out any one that is more important than the rest, but when we take into account not only the benefit to the man himself but to his industry and to his country as well, number nine stands out well above the others.

We feel that the matter of sound investment of the worker's savings has been given so little attention and holds out such possibilities of good both for himself and for the country at large in the present serious situation that it is deserving of careful thought.

For a Free Exchange of Ideas

PROBABLY two-thirds of our industrial disputes are directly due to ignorance or misunderstanding. Most of the time the men don't understand the position of the management because they have been kept in complete ignorance of managerial problems by the negligence and inertia of the executives and by the malicious intention of some of their own leaders.

On the other hand the management is sometimes in much the same position because no one has made it his business to get close enough to the men to find out what they think and to try to straighten out trivial difficulties.

Underneath it all is a woeful lack of knowledge of the simple fundamental economic principles that govern all industry and commerce.

A most commendable attempt to solve both of these problems at the same time is the Open Forum Movement described on another page by Alvan T. Simonds, president of the Simonds Manufacturing Co. Mr. Simonds has the right idea. Intelligent and free discussion will bring together some of the most violently opposed antagonists and reconcile conflicting contentions.

Save the Air Mail Service

ECONOMY and retrenchment should be our watchword, but there are cases where apparent economy is decidedly expensive. Firms are sometimes tempted to curtail their research departments. But they usually find that they lose more than they save.

We heartily approve the motive of economy as expressed by the House of Representatives when it slashed a million and a quarter from its appropriation bill. The great difficulty is that it picked the wrong item, the Air Mail Service. This is a research department for the development of commercial aviation in this country. Incidentally it can by no means be called an expense as it gives at least some return on the investment in the way of saving railroad expense for carrying mail. Some figures indicate that the air mail cost no more than that sent by rail.

Every country in Europe is using the airplane in mail service to an increasing extent. They all credit our Mail Service as the best in existence. And now it is proposed that we abandon it all to save an appropriation of one and a quarter million dollars.

This amount is about one-twentieth of the cost of one modern battleship. Can there be any question as to which expenditure is of the greater good to the country?

Let us by all means be economical. But let us reduce expenses where they do not stop the development of a new industry, an industry which originated in this country and in which we should regain the lead we lost before the war.

In reducing expenses it is well to consider first the heaviest items and those which mean the least in human development. Cutting one first-class battleship from the naval appropriation will look after Air Mail Service for twenty years, at the rate proposed this year.

The Air Mail Service must not be abandoned!

How To Get Rid of Hard Times

The Open Forum as a Means of Settling Disturbing Differences — Economic Ignorance the Cause of Many of Our Troubles

By ALVAN T. SIMONDS
President, Simonds Manufacturing Co.

MAN can do only three things—he can feel, think, and act. Without the benefits of education and civilization, his actions are almost wholly determined by his feelings. As he advances up the scale he more and more subdues his feelings and is guided by his thinking. Feeling is based to some extent upon knowledge; but what a man thinks is determined almost wholly by what he knows.

It is always possible to tell how any man will react in any situation provided you know all about the man, his inheritance, his training, experience and knowledge. Every man reacts to a new thought or a new situation according to what he is. We see with what we are, and we are so made that it is absolutely impossible to see, judge, determine or act in any other way. Because men are different in heredity, in experience and education, they see things differently, and act upon them differently. By meeting each other and discussing the problems before them, men become more alike and therefore more given to similar thinking and acting. Take two extremes—a rabid Bolshevist and an equally decided Reactionary, put them together in the same prison cell (where some people say they both ought to be) and leave them there long enough to talk the matter out and they will be very much closer together in their views and in what they would do if given freedom of action.

The Open Forum Movement is based upon this truth. It brings men together in public discussion of important questions. It increases their knowledge and decreases the likelihood that they will act guided only or chiefly by feeling. Feeling is really heat, knowledge is light. Each man in his mental action has only about a certain amount of the two combined. If much of it goes to heat, there is less light. If little of it is expended in heat, there is much light. The motto of the Open Forum Movement might be "Less heat and more light" in thinking and acting upon public questions.

Practically every one knows that his life is determined by law. His behavior is determined by the laws which society makes to protect itself from the unrestrained individual. Men familiarize themselves with these laws and usually obey them. They know if they fail to obey them that sooner or later they will be removed from troubling society and confined within the walls of a prison. The individual seeks to know and to obey laws of health. He realizes that if he violates them, he will suffer physically and be weakened or rendered inefficient or perhaps removed entirely by disease.

Most men live for growth, success and happiness, but few realize that these are determined by the action of economic laws that are as sure and constant as the laws of gravitation, and much more so than the laws enacted by society through its law-making bodies. But nearly every one is ignorant of these laws and little encouragement has been given to remedy the situation.

The public press has its articles dealing with economic subjects, but they are usually on the financial page and read by those who already are familiar with the principles of economics, and need this additional instruction less than others. Rarely does a magazine publish an article on economics because the public can not or will not read it, for the men and women who make up the public have no background of thinking along economic lines, to make the article of interest to them. Very few attempts have been made to publish the simplest economic ideas in a form suited to a public that has practically no economic knowledge.

Our schools do not teach economics until the college age and then usually only to those who elect it. The public high schools, almost without exception, omit it from their courses of study, and the normal schools training the teachers of the coming generation have entirely overlooked it.

Yet it is true that almost every act of every man's living is determined to a greater or less extent by economic laws that he might understand and apply.

A group of factory foremen, in meeting to discuss simple economic bases of their work, were asked the following questions: Are you in any measure responsible for the industrial depression existing at the present time? If so, how? Can you do anything to remedy it? If so, what? To the ordinary man these questions are about as blind as "Are you in any way responsible for the coming eclipse of the sun, and can you do anything to prevent it?" Yet both are according to law, and some day one will be predicted with almost as much accuracy as the other.

The best means available at present of interesting the public in this question, seems to be the Open Forum where problems of citizenship and economic relations can properly be discussed.

In order to start an interest in the public schools, I am offering two prizes for the best essays upon "The Teaching of Adam Smith in the Wealth of Nations Applied to the Present Economic Situation." These prizes are $1,000 for the best essay and $500 for the next best and are open to high school and normal school pupils.

The offer was made not only to stimulate an interest in the study of economics, but also to discover how far public school education had prepared the soil for planting the seeds of such a subject. The prizes were made comparatively large in order to make them worth while as a recompense for the work necessary, and to attract as nearly as possible 100 per cent of those ready to undertake such a task. The results will be of extreme interest and will show fairly well the attitude of high school pupils and normal school pupils in the United States toward economics.

The Public Forum will reach those who are older but something additional should be done, and done right away in our public schools. I understand the study of economics has been required in the last year in all the high schools of greater New York. It is to be hoped that this good example will be followed by many others.

SHOP EQUIPMENT NEWS

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

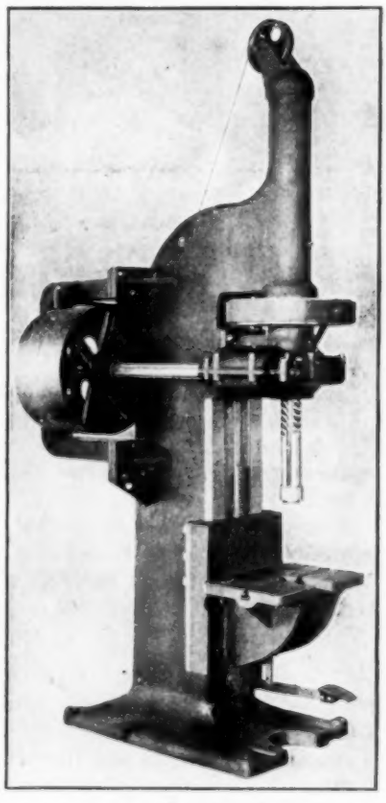
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

General Manufacturing Co. "Flexible" Power Press

The General Manufacturing Co., Detroit, Mich., has placed on the market the power press shown in the illustration. The machine is called "flexible" because the amount of pressure applied by the ram can be varied by the operator from a few pounds to 20 tons, depending upon the pressure applied to the pedal. It is stated that a wide range of work can thus be handled, the machine being adaptable to such work as push broaching, straightening, and pressing in bushings. The ram has a stroke of 18 in. and the position of the knee is adjustable, a maximum distance of 28 in. between the table and the ram being obtainable. The knee is adjusted for height by means of a rack and pinion, and it is held in position by clamping gibs tightened by six nuts, and by a spring plunger engaging teeth cast in the front of the column.

The column is of the box type. The machine is belt driven, the power being applied to the ram through a worm and worm gear of 10 to 1 ratio, running in oil. There are two ¾-in. keys fitting in splines on the ram, which thus runs at constant speed in one direction. The ram is threaded and the nut, which forms the drum for the friction brake, fits on it and turns with it when the ram is not moving vertically. When the asbestos-lined brake band is tightened against the drum by means of the pedal, the nut is stopped from rotating, thus causing the ram to travel downward at a speed of 100 to 140 in. per minute, depending upon the speed of the driving pulley. When the ram strikes the work and is stopped from moving downward, the pressure builds up so that the clutch slips and the nut revolves as before, thus making it possible to maintain constant pressure. When the pedal is released, the nut can revolve freely, and the ram is raised quickly by means of a counterweight inside the column. The end thrust from the ram is taken by means of a ball bearing between the nut and the column casting.

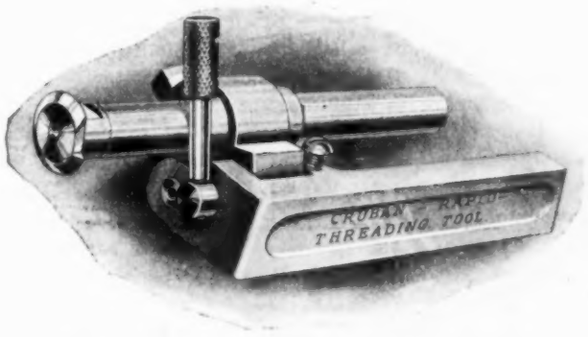


GENERAL MANUFACTURING CO. "FLEXIBLE" POWER PRESS

Cruban "Rapid" Internal Threading Tool

An internal threading tool, shown in the illustration, has recently been placed on the market by the Cruban Machine and Steel Corporation, 63 Duane St., New York, N. Y.

The cutting tool is mounted on a bar carried in a bracket hinged on the shank of the holder. The tool can thus be moved through a small arc by means of the lever.



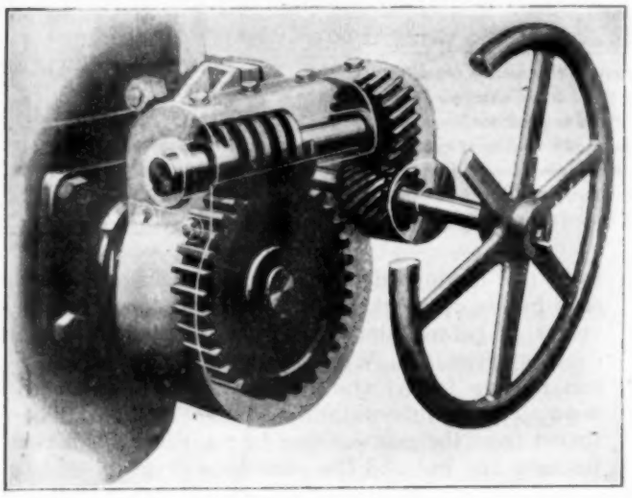
CRUBAN "RAPID" INTERNAL THREADING TOOL

When the cut is started, the lever is turned down. When the end of the cut is reached, the lever is raised manually, thus dropping the cutter back out of contact with the work. The feed is then reversed so as to bring the cutter to the starting position, the cross-slide being fed in to the proper depth for the next cut. By means of a screw, the amount of swing of the tool can be limited, so that the back of the tool does not strike the threads. Thus, the machine can be kept running continuously without the necessity of withdrawing the tool from the work by means of the toolslide, when reversing the feed motion. The device is made in three sizes, the shanks being ⅜ x ⅞, ½ x 1¼ and ⅝ x 1⅜ in. in size.

The smallest diameter of hole that can be threaded is $\frac{5}{16}$ in.

Whiting "Helical-Worm" Geared Crane Ladle

The illustration shows the pouring device used on a crane ladle recently put on the market by the Whiting Foundry Equipment Co., Harvey, Ill. The device con-



POURING DEVICE ON WHITING CRANE LADLE

sists of a pair of forged-steel helical gears actuated from the handwheel, and a worm engaging a gear mounted and keyed on the trunnion of the ladle. The use of the worm-gear makes the device self-locking. The worm shaft is placed at an angle, so that the forged-steel worm meshes properly with the straight teeth of the large cast-steel gear. Different ratios of helical gears can be provided, so as to vary the speed of tilting the ladle. All gears have machine-cut teeth. They are inclosed in a dustproof cover, are readily accessible and can be oiled through small oil holes with spring caps.

The gearing is mounted on the trunnion instead of on the bail, so that distortion of the ladle or bail, or wearing of the trunnion journals, will not interfere with the alignment of the gears. The ladles can be furnished for either iron or steel.

"Cinch" Steel Cement

Deeds & Chapin, 2130 Montcalm St., Indianapolis, Ind., has recently placed on the market, under the name of "Cinch Steel Cement," a compound for joining pieces of steel. It is in the form of a powder and is intended for fastening high-speed steel or stellite to low-carbon steel in making cutting tools, punches, dies and shear blades. When tipping the cutting edge of a lathe tool, such as shown in the illustration, it is stated that only 3 per cent of the tool need be made of high-speed steel. Besides securing cutting edges to different types of tools and knives, the cement can be used for fastening the

LATHE TOOL WITH CUTTING BIT FASTENED BY "CINCH" STEEL CEMENT

tool-steel wearing surfaces on punches and dies of the kinds used both for ordinary forming and cutting and for hot forging.

The cement melts at approximately the hardening temperature of high-speed steel, or 2,200 deg. F. Thus, the cementing and the hardening of the tool can be done at one heating, it being allowable to cool the cemented tool by oil or airblast, if desired. Quenching in air only is used for stellite. It is stated that the cement fastens the steel parts securely and solidly supports the cutting edge, and that one pound of it is sufficient to cement in place 250 pieces each 1-in. square.

Lavoie Pilot-Bar and Drill-Press Chucks

The Frontier Chuck and Tool Co., 30 Letchworth St., Buffalo, N. Y., has added two models to its line of Lavoie air-operated chucks, such as described on page 291 of the *American Machinist*. They are made with either two or three jaws, in either the manufacturing or the adjustable type, and in four sizes, 10, 12, 15 and 18 in.

The chuck shown in Fig. 1 is intended for use when the tools used are equipped with pilot bars. The pilot

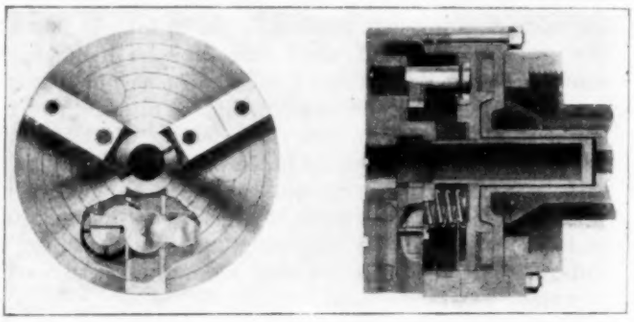


FIG. 1. LAVOIE AIR-OPERATED PILOT-BAR CHUCK

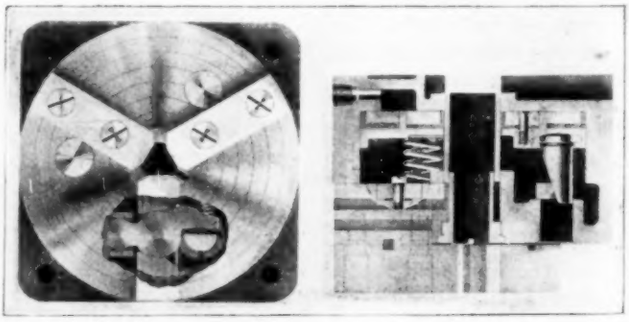


FIG. 2. LAVOIE AIR-OPERATED DRILL-PRESS CHUCK

bushing is screwed into the chuck and does not slide on its seat.

A chuck intended for holding work on the table of a drilling machine is shown in Fig. 2. The bushing extending through the center of it allows chips to fall through, so that they do not get into the mechanism of the chuck. The base rests on four legs, thus raising the bottom of the air cylinder about 1 in. above the table, so that chips can be easily removed.

Contour Buffing Machine

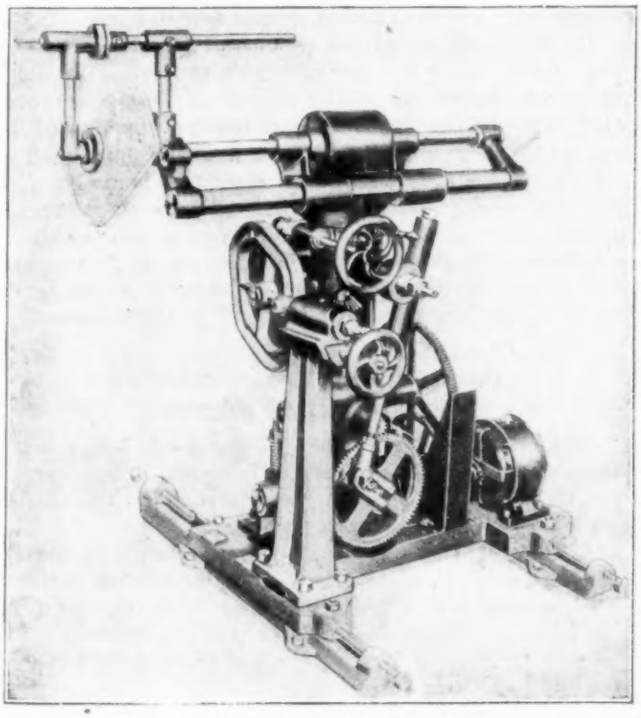
The Contour Buffing Machine Co., Inc., 410 Bird Ave., Buffalo, N. Y., has recently placed on the market a machine, shown in the illustration, for feeding against the wheels of standard buffing or polishing lathes, articles of circular, oval, triangular or rectangular form.

The machine is driven by an electric motor attached to the bed plate, which rests on rails that permit a travel of 8 in. to or from the polishing wheel or buff, so as to suit work of different diameters and different sizes of polishing wheels. The work-carrying spindle is slowly rotated and is supported on a sliding frame that has a mechanical reciprocating motion adjustable up to 16 in. in length.

The column is supported on trunnions at the bed plate and is free to oscillate through about 10 deg. When polishing the periphery of an article of irregular contour, the oscillating movement is controlled by a cam suited to the shape of the piece. When the article is of circular form, the cam is not required and a link is substituted, thus keeping the column stationary. The upper part of the column and the sliding frame can be swiveled by means of a worm gear and handwheel, so that the operator may swing the article to or from the buffing wheel without stopping the machine.

The article being polished is held on the chuck by the work holder, the outer arm, which holds a wooden washer, being pulled against the work by a long adjustable-tension spring inside the pipe at the top. This outer arm is held in position by stops, but can be swung through a half circle, where it stays while the article is being removed from the chuck and another put on. A variable-angle attachment can be fitted to the outer head of the sliding frame for use when polishing conical articles and bottoms of pans. The motor is reversible, the work being presented to the polishing wheel with a direction of motion opposite to that of the wheel. The machines are made right- and left-handed, as two machines are run in conjunction with one polishing or buffing lathe by one man.

Various modifications of the machine can be furnished to suit special requirements. If the articles to be polished or buffed are all of circular form, the cam mechanism can be dispensed with; and for many classes of work the mechanically operated reciprocating motion is not necessary, as the sliding frame can be moved easily by hand to any desired position and locked there. The complete machine when boxed for shipment weighs 1,000 lb., and the outside measurements of the crate are 44 x 30 x 45 in.



CONTOUR BUFFING MACHINE

Spurgin Belt-Shifting Device

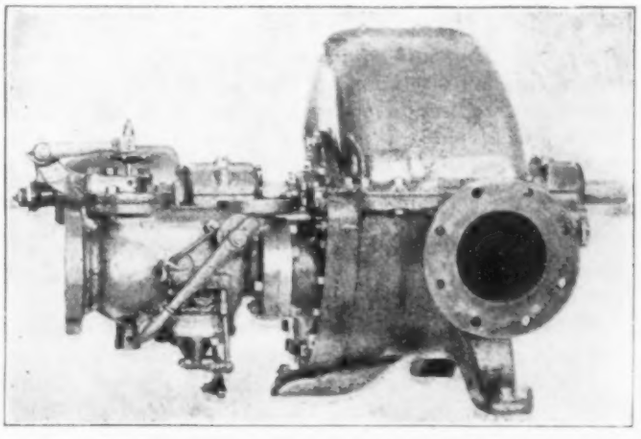
The Spurgin belt-shifting device, shown in the illustration, has recently been placed upon the market by the R. G. Haskins Co., 27 S. Desplaines St., Chicago, Ill. It consists chiefly of two strikers or guides, one at the top and the other at the bottom of the belt and operated by a single lever, so as to enable the shifting of the belt on the cone pulleys. The operator can thus move the belt from one step to another with one hand, it being claimed that the action is performed so quickly and easily that the shift can be made while a cut is being taken. It is stated that, consequently, the proper speed of cutting can better be maintained. The belt need not be touched with the hands, so that the device makes belt shifting safer for the operator.

SPURGIN BELT-SHIFTING DEIVICE

The belt guides are fitted with rollers running on oilless bearings, both on the edges and on the faces of the belt, so that it is not damaged by the guides. They are automatically locked in position, so that the belt stays on the steps to which it is shifted.

G. E. Curtis-Type Steam Turbine

The General Electric Co., Schenectady, N. Y., has recently developed a turbine of the Curtis type suitable for driving such apparatus as centrifugal pumps and blowers. The turbine is made in either one, two, or three stages, and operates at steam pressures of from 50 to 300 lb., either with or without superheat, and either condensing or non-condensing. The illustration shows a two-stage, type-*L* unit.



G. E. CURTIS-TYPE STEAM TURBINE

The turbine is heavily and rigidly constructed. The casing is divided horizontally into halves, the upper of which can be easily raised for inspection or removal of the wheels. The steam connections are so arranged that they need not be disturbed when it is desired to remove the top of the casing. The steam passes through the first-stage nozzles from the steam chest, the nozzles being opened or closed by hand valves placed in the steam chest. The governors control the flow of steam to all nozzles.

The turbine is equipped with speed control in the form of a centrifugal governor, and, if desired, an emergency governor also. The former is of the centrifugal, tension-spring type, the motion of the weights being transmitted through ball-bearing connections to the governor valve. The speed may be adjusted while the turbine is running by a simple operation of the governor valve. The emergency governor operates independently of the main governor when the speed rises to about 15 per cent above normal.

Cancellations

BY J. P. BROPHY

In the last few months many have suffered in the extreme through reckless cancellations. Is it possible that a contract between two people can be ignored in a somewhat flippant manner by stating that "Owing to business not being very satisfactory we would ask you to kindly cancel the machines that we ordered from you some time ago?" This has been going on so frequently that it is noticeably damaging to a vast number of people in the manufacturing business.

In many instances machines are ordered, and also the necessary special equipment for producing, but nevertheless the purchaser ignores his obligations to the extent of forming a flimsy excuse to bring about a complete cancellation, which means that the tools and equipment of various kinds that the manufacturer prepared at considerable expense are not in the mind of the purchaser as a reason why he should pay for this equipment.

The trouble is that orders are placed when business is good for large quantities of merchandise. The plans of the manufacturers have to be along the lines of ordering material of all descriptions, carrying along the necessary parts to take care of the orders on their books. Something happens that the business of the country is lessened in the extreme through strikes, scarcity of money or other reasons. The first thought that has come to some people is to unload their obligations regardless of their contracts and the effort put forth by the manufacturer to produce that which the contracts call for. They seem to care nothing about those they do business with so long as they can extricate themselves from paying for that which they claim they cannot make use of. This manner of doing business has unquestionably had considerable to do with many receiverships that have been appointed in the last few months, because it places a burden on the man who has received the order and invested his money to produce what the customer called for. Consequently a vast amount of capital is tied up on account of those who are not inclined to do business in an honest way.

Without question many of those who have been countermanding their orders for material are likely to stand pat in any case where someone has purchased some of their product, by forcing them to accept according to contract, which is considered legal to their way of thinking when looking at their side of the question, but illegal when considering the other ellow. Is it possible that such selfishness is going to continue and that all contracts will be considered as nothing more than the paper they are written on regardless of the great loss to multitudes?

The Kaiser in the late war when forcing his way into Belgium considered the treaties between countries as nothing but mere scraps of paper. This we all condemned very vigorously when it actually occurred but a vast army of business men is following very closely in the footsteps of this same Kaiser in the manner of doing business. If we all had considered this question in an honest way when times became dull a few months ago, and approached one another honestly, not attempting to break contracts in a reckless way, then the business of today would be vastly better than it now happens to be. The exchange of ordered product, if accepted by all individuals would have kept money moving in business circles. But some were unprincipled, unloading their burdens by cancelling, and were instrumental in the laying off of a great number of men, which could possibly have been avoided.

Some even go to the extent of plainly stating, "If you do not like to accept cancellations, go into the courts." Now this is easily said but not so easily carried out. None of us care to take a case to the courts because a man will not accept our product, because this same man, undoubtedly, when forced to accept, would find the most flimsy excuse for not making payments, by claiming the goods as not up to the specifications, however, the only alternative in some instances is drastic action, allowing the law to settle the case.

To evade living up to your contract, having in mind the possibility of price reduction, regardless of the damage to others, is without question a most contemptible procedure. If we all had sincerely considered this question and asked for extended time for making payment, forgetting unscrupulous cancellations, the stability of business would to a great extent have been maintained, but as it is today, we have in many instances shamefully ignored all that means fair dealing.

In these dull times we should all stand together as one mighty force for our country's welfare. We did it to defeat the enemy in the recent war for self protection, but now we seem to have become enemies of one another, using unlawful means to avoid our business obligations. If it were otherwise, the banks unquestionably would relax somewhat to help us solve our present business depression, but when we disregard our contracts with impunity our bankers are perfectly justified in considering our action and protecting themselves, because they question seriously our business sagacity.

Reduction in the Number of Locomotive Failures

Reduction in the number of passenger-train detentions due to locomotive failures is shown in a statement for the month of October just compiled by the eastern region of the Pennsylvania system.

In October, there were 521 passenger-train detentions on the eastern region caused by locomotive failures. The number was eighty-three less than the total for the previous month, and 364 less than the number occurring in October of last year, when there were 885 such detentions.

Annual Meeting of Society of Automotive Engineers Brings Out Valuable Papers

Automobile and Airplane Sessions Hold Center of Stage—C. F. Kettering Explains Chemistry of Engine Fuels—Beecroft Elected President

THAT the automotive engineer has a clear idea of his responsibilities in these unsettled times was made plain at the annual meeting of the Society of Automotive Engineers in New York. As usual, the meeting was held during automobile show week and at the Engineering Societies Building. The Standards and Sections Committee meetings were held both morning and afternoon of Tuesday, January 11.

The first professional session took place on Tuesday evening and was devoted to aeronautical engineering. Glenn L. Martin, aeronautical vice-president of the society, was in the chair. The papers were as follows: "Propellers," by F. W. Caldwell; "Design Requirements of Commercial Aviation," by Grover C. Loening; "Airplane Wings," by C. O. Hanscom; "Progress in Military Aeronautics," by Major Thurman H. Bane.

Some of the statements made by Mr. Loening met with considerable opposition from some of the members present and resulted in valuable discussion.

The Commercial Aviation Session was well attended. Glenn L. Martin, who also presided, read a paper. Professor E. P. Warner told what was being done in Europe; Ralph H. Upson, of ballon and dirigible fame, showed where the different methods of transport are to find their fields; and S. W. Sparrow had a paper on "Compression Pressures and Engine Performances."

Major Leon B. Lent, who has charge of the Air Mail Service, spoke of the work which had been accomplished, the time saved and the reliability record. He told of the handicaps of using planes built for war purposes rather than for mail.

There was some difference of opinion as to the advisability of using large, multi-motored planes, or smaller planes with single motors. As was to be expected, this seems to depend entirely on the service required, both as to distance, loads and the character of the country over which the flight is made.

Business Meeting

The annual business meeting was held Wednesday morning and was devoted to the address of the retiring president, Col. J. G. Vincent, and the usual committee reports. Then H. M. Crane and Col. H. W. Alden told of their ideas as to the position of the automotive engineer in his industry and of his chances for the future. Both men said that the engineer could make of himself and his department what he pleased, that the industry was face to face with a turning point in its career where the survival of the fittest only was possible, and that the engineer was the man on whom the burden of foreseeing future developments would rest.

On Wednesday evening the annual carnival was the center of attraction. It was well up to the usual standard of the society's affairs of this nature and was thoroughly enjoyed.

As in former meetings the fuel session attracted the most attention. But instead of listening to various more or less authoritative estimates of the supply of petroleum in the earth and the length of time it would last, the members discussed ways and means of improving the automobile to make the fuel supply last longer.

Former president Kettering was the first speaker at the morning session on Thursday. He prefaced his remarks by admitting that the fuel situation is the dead line in the automotive industry and went on to say that great progress had been made during 1920.

Mr. Kettering then took up the chemistry of fuel combustion in the internal combustion engine cylinder and described what actually happened in a way that would have driven an old chemistry professor to drinking the alcohol in his own laboratory. His hearers, however, got the idea perfectly.

The research work of Mr. Kettering and his assistants has resulted in the discovery that the addition of the correct percentage of colored aniline oil to what is sold commercially as gasoline eliminates all tendency to knock and permits the use of higher compression ratios. The compound is also an excellent carbon remover. The work has not as yet reached the commercial stage.

The next speaker, Frank A. Howard, of the Standard Oil Co., took up the volatility of motor gasoline and showed that the vapor tensions of the various constituents of that complex fuel are such that condensation is practically impossible under ordinary conditions and that consequently any liquid fuel that appears in the cylinders or crankcase was never really volatilized. He showed the apparatus used to determine vapor tension and demonstrated its operation.

The last paper of the morning session was by C. A. Woodbury and the subject was "Flame Propagation in a Closed Cylinder." As Mr. Woodbury was unable to be present the paper was read by one of his assistants.

Afternoon Schedule of Papers

The papers scheduled for the afternoon session were as follows: "Thermostatic Inlet Temperature Control," by R. E. Fielder; "Résumé of Bureau of Standards Fuel Study," by Dr. H. C. Dickinson, of the Bureau; "Fuel Problem in Relation to Engineering Viewpoint," by A. L. Nelson; "Mixture Flow in Manifolds," by P. S. Tice; "Symposium of Answers to S. A. E. Questionnaire."

Mr. Tice was not present and as his paper was in print it was not read. The feature of the session was Mr. Nelson's paper. The author described road tests made on a modern high-grade car and emphasized the need for a complete change in engineering viewpoint. In his tests the engine never reached even quarter load at speeds below 40 miles per hour, the average figures ranging from 16 to 19 per cent.

Mr. Nelson went on to show how he changed his viewpoint and what radical departures he made from accepted practice. They are too far reaching and comprehensive to be covered here. His conclusions, however, are interesting. He believes that with high-compression pistons, higher axle ratios, better fuel vaporizers and different transmissions, we can get "miles per gallon" figures 100 per cent higher than those now obtained.

Interesting figures on the percentage of carbon monoxide gas in automobile engine exhausts were presented by Mr. Fieldner, of the Hudson Vehicular Tunnel engineering staff. They were obtained in tests run to obtain data for the design of the tunnel ventilating system and showed that approximately 7 per cent of the exhaust gas is CO.

The session on body engineering was also held on Wednesday afternoon, with W. G. Wall as chairman. The papers were: "Passenger Car Designing and Its Problems," by Andrew F. Johnson; "Can Body Weight be Reduced?" by Charles A. Heergeist; "Automobile Body Style," by George J. Mercer; "Relation of the Body Engineer to the Industry," by Kingston Forbes; "All-Steel Body Methods," by George E. Goddard.

The discussions were pertinent and brought out many good points as to best material to be used, governed largely by quantity to be produced and method of finish to be used on the bodies.

It was deplored that there is such a lack of co-operation between the chassis engineers and body engineers. The statement was made that the body design was much affected by the method of suspension of the engine and the general framework of the chassis.

Many times, too, a body design would be turned down by the chief engineer of the plant, who would not be nearly so competent to judge body design as the man who designed it. Along this line it was suggested that the next meeting should have a joint session of the chassis and body engineers.

A recommendation was passed that steps be taken by the society to establish a school, or courses in schools, for teaching body designing and drafting.

An excellent series of movie films was shown by the Dodge Brothers body engineer, illustrating how their all-metal bodies were made, step by step, and the assembling methods used.

The annual dinner which wound up the meeting was particularly enjoyable, with the inimitable C. F. Kettering as toastmaster. There were over a thousand present, including representatives of the Army, Navy and Post Office departments.

R. E. M. Cowie, vice-president of the American Railway Express Co., spoke on the "Co-ordination of Transportation" and urged the simplification of the motor vehicle as the best way to increase its field of usefulness. He further urged that immediate attention be given to the development of aircraft for commercial purposes. This necessitates the preparation of landing fields, of aerial beacons to compare with the lighthouses which guide the mariner at sea, of directional wireless apparatus and other devices which make for safety and continuity of operation. This is just as much a government function as that of marine navigation. And when we can depend on a regular air service there will be no lack of work for it to do.

Mr. Kettering defended the engineers on the question of simplification; stating that they have always been handicapped by the sales department urging the adoption of devices as talking points. Until recently they had been urged to produce in large quantities, as there were not enough cars. Now with the sales at a low point, they were being told that they were not good enough to attract customers.

The financial situation was discussed by George E. Roberts, of the National City Bank, who pointed out that the times were out of balance. And, just as an engine out of balance does not run well, so the world is limping along as best it can. He was optimistic as to the future, but said that balance cannot be regained until all the factors conform to the readjustment. While pre-war conditions will never return in all particulars, the returns from labor or capital must purchase as much as before, in order to restore equilibrium. He also pointed out that this country could not consider itself as a separate machine, as it was a part of the world. And as long as Europe was out of balance, this country could not get to running smoothly.

The new president, David Beecroft, also made a short address.

Cutting Metric Threads Without a 127-Tooth Gear

By Chester E. Josselyn

A. W. Forbes, article entitled "Know What You Are Doing and Why You Do It," published on page 612 of *American Machinist*, no doubt struck a responsive chord in the minds of many readers. He concludes by saying: "A way that leads to knowledge, but often to various troubles also, is to break every rule and see what comes of it."

Some time ago I had occasion to cut some metric threads on a lathe having a 4-pitch, single-thread lead screw. The first method that suggested itself was to use a 127-tooth gear in connection with the regular gears, but after some thought upon the subject I decided that the odd gear was not necessary, for with the regular gears I could cut metric pitches with but little variation from exactitude.

Instead of using the constant 5: 127, which represents one millimeter, I used the constant $4\frac{1}{2}$: 108, equaling 0.03935; a difference of but 0.00002 in. By basing my gear calculations upon this ratio I was able to cut fifty 1-mm. threads with a variation of but 0.001 in.; and in the case of larger threads ten 15-mm. threads showed an error of but 0.0028 in. in the entire length of nearly 6 in.

The rule to use for finding the gears is as follows: The product of driving gears must equal the product of the thread pitch in millimeters multiplied by the pitch of the lead screw times the factor $4\frac{1}{2}$; the product of the driven gears must equal the other factor, 108, thus:

For example we wish to cut an 8-mm. thread upon a lathe the lead screw of which is 4-pitch, single-thread.

Product of drivers $8 \times 4 \times 4\frac{1}{2} = 8 \times 17$

Product of driven gears $108 = 9 \times 12$

As we have neither 8-, 9-, 12-, or 17-toothed gears we multiply these factors by some common multiplier, say 5, to find gears that are available, thus:

$8 \times 5 = 40$, $17 \times 5 = 55$ drivers; $9 \times 5 = 45$, $12 \times 5 = 60$ driven gears

To prove the actual lead cut by these gears we have but to establish the ratio of stud to lead screw thus:

$\frac{8}{9} \quad \frac{17}{12} \quad \frac{24}{27} \quad 1\frac{7}{27}$

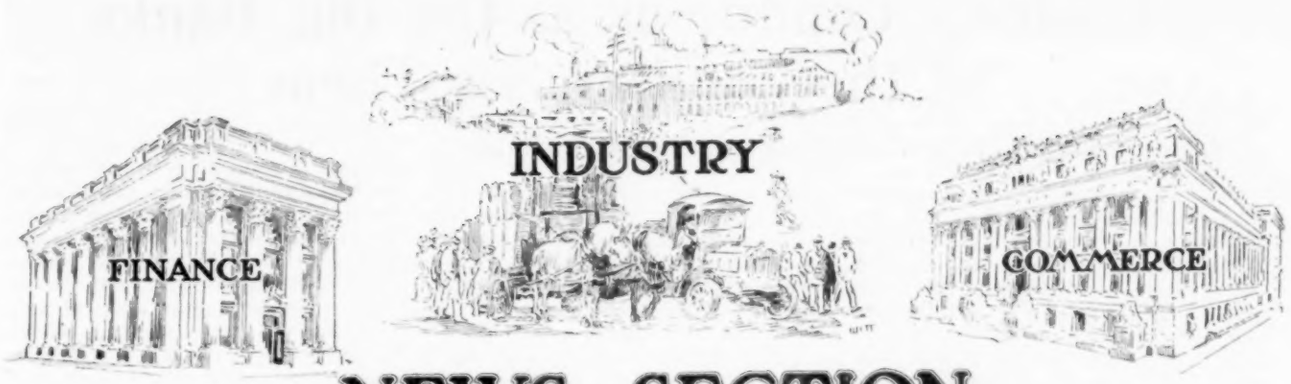
and multiply it by the lead of the screw

$1\frac{7}{27} \times 0.250 = 0.314813+$

Subtracting this from 0.31496 (8 mm.) we have

$0.31496 - 0.314813 = 0.000147 \times 8 = 0.001176$ in.,

an error approximating 0.001 in. for every eight threads cut.



NEWS SECTION

New York Motor Show Sales Please Dealers

Enthused with the unqualified success of the twenty-first National Automobile Show at New York nearly 1,000 automobile manufacturers and their representatives made merry at the annual National Automobile Chamber of Commerce banquet at the Hotel Commodore recently. The enthusiasm is due to reports that the public is buying cars at the show. The show has surprised New York dealers. They expected to have to go out and look for business. Three days of the show have proved to them that cars are in demand.

At the dinner Francis H. Sisson, vice-president of the Guaranty Trust Co. of New York, told automobile men about the credit situation with reference to the industry. Mr. Sisson in his speech told the automobile trade frankly that bankers would finance business, but only when conditions necessitated funds.

At the Grand Central Palace in making the round of exhibits the six-cylinder car was was still found to predominate. New models of cars making their first appearance are pretty evenly divided between fours, sixes and eights. More complete equipment is another noticeable tendency. In this sense equipment is held in the light of regular installations on all production cars at the factory and not extra fittings, which may be attached later to meet the individual needs of different owners. Luxuriously equipped vehicles that catered to the comparatively few in other shows are not so conspicuous this year.

Throughout the show there is noted a trend toward better cars rather than the introduction of radical designs. Refinements include improved engines aiming at greater economy of operation. Chief of the improvements is that of carburetor systems to cope with the decreasing grades of fuels.

Another Metric Bill

Representative Britten, of Illinois, has introduced in the House of Representatives a metric system bill identical, except for two or three minor changes in verbiage, with that introduced a few weeks ago in the Senate by Senator Frelinghuysen, of New Jersey.

Lumber Back to Normal

In an article prepared by the Northern Pine Manufacturers' Association and published in the advertisement sections of newspapers in an effort to prevent continued building stagnation to bring about a resumption of construction activities, it is stated that "lumber prices have been reduced from 40 to 45 per cent."

"While it is true that lumber is back to normal," it says, "it is necessary for the public to know that lumber represents only about 30 per cent of the total cost of the ordinary building. The remaining 70 per cent which goes to make up the balance of the cost has not returned to the normal basis.

"That is the reason why the cost is still out of line and building operations cannot be financed. Money is only available for this purpose when the entire building can be erected at normal costs. Otherwise the security is not attractive.

"Not only is lumber down, but farm products have fallen in the same proportion. Wheat, oats, corn, flax, cotton, wool, cattle, hogs, hides, and any number of such items are back to normal. These basic products form the foundation upon which is built the purchasing power of the general public.

"Under such circumstances, building operations will not start until the 70 per cent represented by plumbing, heating, hardware, lighting, painting and labor get back to normal.

"The reluctancy of the '70 per cent' to get back to a normal basis, has stagnated building activities. There will be no resumption of work until these prices return to normal.

"This is one of the principal reasons why labor is, at the present time, unemployed, and why the situation is becoming worse every day.

"The public has decided the question. It is not buying and it will not resume buying until everybody is willing to get back to a normal basis. As soon as this is brought about things will begin to move. Money, which is always available when building costs are normal, will be plentiful. People will begin to build homes. Rents will begin to come down. Building materials will begin to move and saw mills will start operations."

Changes in the Office of the Director of Sales

The office of the Director of Sales has been militarized. The new director of sales is Lieutenant-Colonel E. S. Hartshorn, of the General Staff. The same general sales policy developed under civilian control of the office, will be continued by Colonel Hartshorn and his associates.

Lieutenant-Colonel William M. Connell, cavalry, and Lieutenant-Colonel William N. Haskell, cavalry, have been designated as assistant directors of sales. Major O. H. Saunders, infantry, will become executive officer, succeeding Major S. D. Graff, whose discharge from the service became effective Dec. 31, 1920.

Colonel Connell will have charge of the plant facilities, railway contractor's equipment and building materials, and machine-tool sections; while Colonel Haskell will supervise the workings of the general supplies, sales promotion, and transfer and inventory sections, also all foreign negotiations and sales, succeeding A. La Mar, whose resignation also became effective on Dec. 31, 1920.

The contract and administrative sections will be directly under Colonel Hartshorn.

The general policy of the sales promotion section will be continued and Charles M. Willoughby will continue as chief of that section.

E. C. Morse, who has been director of sales, and Mr. La Mar, the head of the division of foreign sales, will enter the service of a large importing and exporting firm. Major H. S. Johnson, of the old organization, goes to the Old Hickory plant as representative of the Ordnance Department. F. B. Grant will resume the practice of his profession as an electrical engineer in Boston.

Calls for Steel Express Cars

Senator Robinson of Arkansas introduced a bill in the Senate on Jan. 11 requiring railroads to equip baggage and express cars with sanitary drinking water containers and facilities, and requiring that after July 1, 1924, all full railway express or baggage cars shall be of steel or shall have steel underframes.

Business Conditions as the Big Banks of the Country See Them

National City Bank of Chicago Is Cautiously Optimistic

Despite the world-wide readjustment in commodity prices and resultant unsettlement in many quarters, the new year opens under circumstances which justify taking a cautiously optimistic view of the future. The country has cast aside all delusions about the possibility of maintaining war prices in peace times and the Federal Reserve Board has rejected all efforts to secure credits with which to support speculative undertakings or to defer the inevitable restoration of a reasonable price level. Congressional leaders are insisting upon the introduction of important economies to offset in part the sharp decrease in the federal tax collections, which must result from the enormous decline in business profits realized during 1920 as compared with those cleared during the previous year of high prosperity, upon which were based the immense tax collections of the year just closed.

This is a favorable sign, for the high cost of government is bearing heavily upon the people and must be reduced forthwith. For more than thirty weeks there have been more recessions than advances reported in commodity prices, which in the nature of things must ultimately reduce the cost of living and make it easier for the industrial worker to make both ends meet. This is of great importance, since wages are being reduced everywhere, not because capital is trying to get the better of labor, but because the country cannot continue wage advances in a period of declining profits. The people are getting back to a sane basis of living and while the liquidation means heavy losses in some quarters, the general influence will be highly beneficial to the great mass of American citizens, 95 per cent of whom are "ordinary" citizens in the best sense of the term.

Bank Credit Generally Devoted to Sound Business Undertakings

There are many problems to be solved and numerous hazards to be reckoned with, but the distinguishing feature about this year as compared with the situation of twelve months ago is that inflation has ceased, extravagance is on the wane, and operating costs are being gradually reduced. These changes are reflected by the decline in the average prices of the stocks of eighteen typical industrial corporations to 64¾, the low level of five years. These shares are selling nearly twenty-eight points below last year and within about one point of the pre-war average. This shows that virtually all the war inflation in these special stocks has been wiped out, for it was in the industrial shares that war inflation was most pronounced. Eighteen railroad stocks show an average loss of only about six points for the year. There has been also a vast reduction in the amount of credit tied up in loans upon speculative collateral, the present estimate for outstanding brokerage loans in Wall Street being $700,000,000 as against $1,750,000,000 of bank credit so employed in July, 1919, when this account was at peak level. It is worth noting also that within the last eighteen months there has been a vigorous campaign waged against unessential loans in the effort to finance productive industry ahead of everything else. This has purified the country's loan account in a remarkable way and it seems safe to say that never has a new year opened with bank credit devoted more generally to the support of genuine business undertakings than is the case today.

Unemployment Still Serious

With the slowing down of business the labor shortage has been not only wiped out, but the country faces today an unemployment problem of considerable significance. This grows out of the partial shutting down of textile mills, silk mills, steel works, and other industries which a year ago were running full time. The railroads have been gradually weeding out the less desirable men, with the result that efficiency in the transportation industry is much greater than it was. It is difficult to estimate the number of unemployed in the country, but a conservative figure, taking in all industries, might show 300,000 or 400,000 men. In Great Britain the labor surplus is materially larger than in the United States. In several instances, however, men and women operatives have petitioned their employers to retain their services at a lower wage if that should be necessary in order to keep the plants in operation. This contrasts sharply with the arrogant spirit of a year ago and emphasizes the changes in working conditions throughout the world. Most employers are trying to do the right thing by their men so as to prevent unnecessary hardships and build up good will. With the slowing down of business the movement towards higher wages has been checked and the strike evil has largely disappeared. It is to be hoped that employers and employees may co-operate so that the splendid organizations built up during the war period may be left intact.

Better Times Ahead

There are better times ahead for the country, provided orderly deflation runs its course and we do not hinder the natural reaction from a long period of inflation. A good deal of constructive legislation will be considered by the next Congress, but the country will not tolerate such changes in the Federal Reserve Act as tend to weaken it, restrict its policy, or restrain the Federal Reserve Board from acting as it sees fit. If ever the country needed high grade financial leadership it is in these days of readjustment and business depression. Our banking system has held up well under a strain which would surely have crushed it completely, had it been unsound or improperly put together.

Guaranty Trust Company Official Points Out Need for Constructive Leadership

In an address at the annual banquet of the National Automobile Chamber of Commerce, Hotel Commodore, New York City, Tuesday, Jan. 11, 1921, Francis H. Sisson, vice-president of the Guaranty Trust Co., said in part as follows:

"The question uppermost in the minds of all business men at this time is 'When will present readjustments be completed and a stable basis for business re-established?'

"While, of course, years must elapse before the tremendous amount of life and property destroyed in the war can be fully replaced and the political and social problems it has created can be solved, there is ample ground for believing that we shall reach a relatively stable condition in this country in the very near future. We have undoubtedly passed through the most critical of our post-war readjustments, although many more must yet be made. And any answer to the question that I have quoted is contingent upon the length of time it takes to effect the remaining necessary readjustments.

"I refer especially to the readjustment of retail prices to declining wholesale prices and the readjustment of the costs of production to present purchasing power. These necessary readjustments have been tardily started, as was to be expected, but they are now under way, fortunately, and will be completed gradually but with ever-accelerating speed. The sooner they are accomplished, with a minimum of distress, the sooner we will reach a comparatively stable business basis, but we cannot reach that basis until they are finished.

"The business conditions of this nation are fundamentally sound. But after the great crisis through which we passed in the World War, and in which we demonstrated our tremendous economic strength, we have relaxed and permitted ourselves to be bound like a Gulliver by Lilliputian uncertainties and pessimistic reactions. With the richest

and most abundant resources, facilities, and capabilities of any nation on earth we stand on the threshold of the New Year in the rôle of a Doubting Thomas, lacking faith in our manifest destiny; supplanting the eagle with the ostrich as our national emblem.

"Leadership that will direct our national thought into logical channels is imperatively demanded at the beginning of 1921. And it will be the duty, as well as the opportunity, not only of the incoming Administration but also of Congress to assume that leadership. It is equally the duty, as well as the opportunity, of American business intests to co-operate fully in giving the country such leadership."

United States Trade with Germany in 1920

Trade of the United States with Germany in the year just ended aggregated nearly $400,000,000 against $533,000,000 in the biggest year preceding the war—the calendar year 1913. This estimate, says a statement by the National City Bank of New York, as to the trade with Germany during the full year is based upon actual figures for the eleven months, which show exports to Germany in the eleven months ending with November, 1920, at $253,000,000 and imports from Germany in the same period $84,000,000. Should the December figures equal or even approximate those of November, the grand total of trade with Germany for the calendar year 1920 would fall little short of $400,000,000, as against the high water mark of $533,000,000 in 1913, for it happened that the year immediately preceding the war showed that our trade with Germany was bigger in value than in any preceding year.

Of course, it does not follow that the approximately $400,000,000 worth of merchandise forming our trade with Germany in the calendar year 1920 represents anything like the *quantity* of material represented by an equivalent sum prior to the war, for, even measured in our own gold standard, the valuation per unit of quantity is now fully twice as much per pound or per ton or bushel or barrel or gallon as prior to the war. But nevertheless it is a fact that in stated value, measured by United States dollars, the trade of 1920 with Germany is about three-fourths as large as in the biggest year preceding the war but in quantity probably less than half as much.

Latest reports regarding the trade of Germany, both those of her own officials and those of other countries, suggest that the United States is now supplying directly and indirectly about one-third of the merchandise entering Germany, most of it coming direct, while a considerable quantity, of United States origin, reaches her through other countries, notably Great Britain, Netherlands, and Belgium, which have always had the habit of passing on to Germany considerable quantities of merchandise which they imported from the United States.

National Foreign Trade Council To Hold Eighth Annual Meeting in May

With its efforts exerted toward securing more definite and aggressive co-ordination of the varied foreign-trade activities and to reinforce them with the co-operation of the various governmental agencies, the National Foreign Trade Council is making preparations for its eighth annual convention in Cleveland, Ohio, on May 4 to 7 inclusive.

All the problems confronting the American manufacturer in his initial reaching out for control of the world's marts will be presented for first-hand consideration.

Save during the convention, which is wholly educational, the Council devotes its energies to promoting and fostering foreign trade extension throughout the world. Its officers, headed by James A. Farrell, president of the United States Steel Corporation, serve without compensation, and its membership of approximately seventy-five representatives of leading commercial, industrial, agricultural, financial and shipping interests defray its expenses. It is strictly non-partisan and non-political.

Growth of Industrial Production

American industrial production during the last ten years has experienced a wonderful and unprecedented growth. Stimulated during the war period by an exceptional foreign demand, manufacturing plants generally increased their producing capacity far beyond their normal requirements. In many instances today their purely domestic trade falls short of consuming their output, with the result that America is more than ever facing a situation where it is imperative that we become a nation of world traders if our industries are to continue in active operation and our prosperity as a nation is to endure. It is a radical departure from former conditions.

In the old days the American manufacturer, generally speaking, was content with his domestic trade. He looked to the foreign markets only in periods of overproduction or depression at home. Under these conditions he shipped his surplus stock abroad with selling instructions and made the best of a bargain that usually was unsatisfactory. His interest in foreign trade naturally was not overly keen. He made no effort to extend his foreign acquaintance and connections. For years our exports, chiefly promoted by the larger industrial interests, averaged but a trifle in excess of 7 per cent of our production.

Under the stimulus of a war-made foreign demand American exports increased from less than two and one-half billions in 1913 to more than eight billions in 1920. The remarkable period of prosperity that attended this revolutionary condition fully awoke the American manufacturer to the tremendous possibilities of a well-developed and permanent foreign trade. But out of it all grew no really definite and lasting foreign connections for the great majority of those who profited chiefly from munition making. It is this class of manufacturer who should be most keenly interested in the problems that will come up for discussion before the next National Foreign Trade Council convention.

Preliminary arrangements for the convention will be in the hands of a committee of fifty representative Clevelanders officered as follows: Samuel Mather, Pickands, Mather & Co., honorary chairman; E. R. Fancher, governor of the Federal Reserve Bank, Myron T. Herrick, president the Society for Savings, Henry Howard, the Grasselli Chemical Co., William P. Palmer, presiden the American Steel & Wire Co., and Ambrose Swasey, president the Warner-Swasey Co., honorary vice-chairmen; and H. F. Seymour, the Columbian Hardware Company, executive chairman.

A. W. Douglas Predicts Good Spring Business

The new year begins with general business conditions throughout the country "poor but sound," says Archer Wall Douglas, chairman of the Committee on Statistics and Standards of the Chamber of Commerce of the United States in his semi-annual review of the business situation issued recently.

According to Mr. Douglas a determined and constructive effort is being exerted to bring about a change for the better by teamwork and co-operation. In the entire absence of any apprehension of a money panic he sees the most encouraging feature of the whole situation.

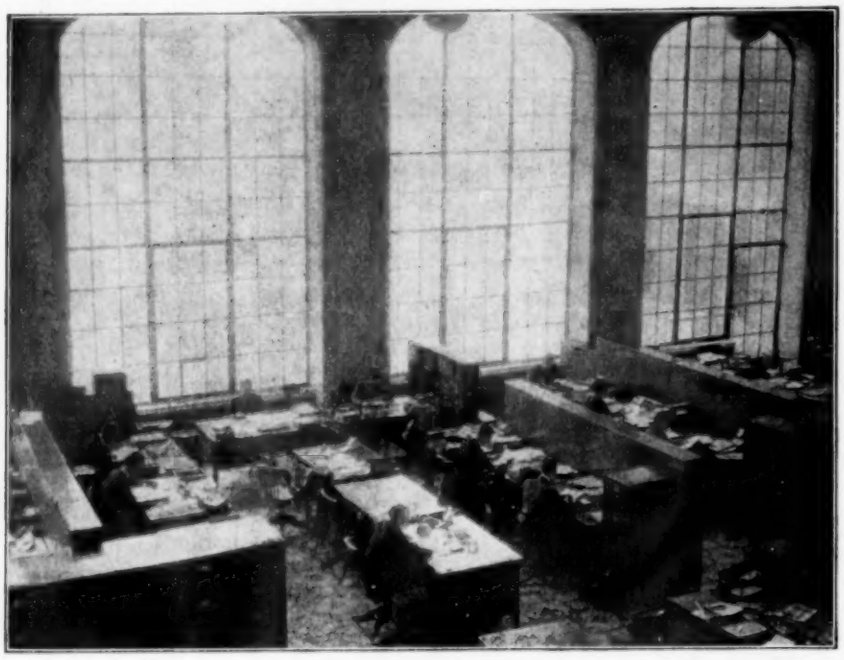
"How long the present situation will last is a subject of much speculation and inquiry," says Mr. Douglas. "The general thought is that the winter months will be quiet and that as the spring opens there will be an appreciable change for the better. In the industrial districts there is a general feeling that the situation will improve when prices of commodities reach a figure that will tempt the ultimate consumer to begin purchasing for other than his immediate wants. It is rather significant that some sales can be made at bargain figures but very few at moderate concessions. The answer apparently is, therefore, that when the readjustment now in active operation has resulted in a sufficiently low level of prices for manufactured commodities, business in the industrial districts will assume more normal proportions."

New Income Tax Bulletin Out

Income Tax Bulletin F on the subjects of depreciation and obsolescence has just been issued by the Bureau of Internal Revenue of the Treasury Department. It should be secured at once by every manufacturer as it may point the way to considerable savings in tax returns.

Evolution of an "American Machinist" Article—I

That *American Machinist* readers and contributors may comprehend more clearly the steps a prospective article must take before being published we are starting herewith a series of picture stories. The illustration shows the home of the editorial force. To the right between the two rows of cabinets Editors Condit and Colvin do their daily labors, while the larger space



to the left houses the remainder of the force, from the typists to the managing editor. In subsequent pictures we will show close-ups of the men through whose hands a contribution must pass; besides showing the various steps that must be accomplished in the mechanical departments. The greater number of contributions arrive in the *American Machinist* office through the mails and these are sorted out in the mailing department and sent to the managing editor. What he does with them will be shown in our next installment.

Astronomical Device for Measuring Angles to One Ten-Thousandth of a Second

Those who have followed the development of methods of making exceedingly minute measurements will be interested in a new device that has just been invented for astronomical work. Like the methods that have been developed for checking very accurate gages this device employs the principles involved in the use of the interference bands of light. The methods developed are stated to be accurate within 0.0001 second of an arc. The exceeding minuteness of such an angle may be appreciated from the fact that it is roughly equal to the angle that would be subtended by a pin-head at a distance of over a thousand miles from the observer.

This new device was developed by Professor Albert A. Michelson of the physics department, University of Chicago, and was described by him before the American Physical Society on Dec. 29, 1920. The method used was first applied with the eight-foot reflecting telescope at Mt. Wilson, in southern California. The mirror of the telescope is obscured by an opaque cap that has two slits. The slits are adjustable both for their width and distance apart. When the instrument is focused on a star, instead of an image of the star, there appears a series of interference bands arranged at equal distances apart and parallel to the two slits. When the slits are separated, a distance between them will be attained at which the fringes of the bands disappear. From the measurement of this distance and by calculating with a simple formula it is possible to ascertain the angle subtended by the star. When this angle and the distance to the star are known it is easy to determine the diameter of the star.

A still more powerful device is obtained by using two adjustable mirrors with an interferometer attachment, instead of the telescope and slots. The latter device was applied with remarkable success to the measurement of the diameter of Alpha Orionis. This star is located in the constellation of Orion and its distance had previously been determined by parallax methods. It has been possible hitherto to determine the distance of some of the nearer stars by measuring their parallaxes, and the masses of binary stars have been computed by methods involving mathematical considerations and a knowledge of their observed periods. However, Professor Michelson's method is the first which has successfully determined the actual diametrical size of a star.

The result of the measurement is astounding. The star Alpha Orionis has a diameter three hundred times that of the sun or equal to that encompassed by the orbit of the planet Mars. If it were placed as near to us as the sun, its brilliant surface would fill the whole visible heavens. Its volume is 27,000,000 times that of the sun.

The method of Professor Michelson has also been applied by a member of the staff at Mt. Wilson Observatory to the measurement of the star Capella. This has been known from spectroscopic observations to be really a double star, although the two stars are so near together as to appear as one through the most powerful telescopes. With the new attachment on the eight-foot reflecting telescope it was possible to measure the minute angle of 0.045 seconds subtended by the two stars, and to determine their successive positions as they revolved in their orbits. The calculated and observed results agreed with astonishing precision, the maximum error being 0.0001 of a second.

Professor Michelson is a scientist of unique distinction. He numbers among his achievements one of the most accurate determinations of the velocity of light. He has applied the methods of light interference to numerous delicate physical measurements of lengths and angles, and among these were his accurate determination of standards of length for the French government. The so-called Michelson-Morley experiment gave much of the inspiration out of which has grown the recent theory of relativity. Professor Michelson has been awarded the Nobel Prize for his researches.

How To Avoid "Cancellitis"

How to avoid becoming a victim of the new business epidemic known as "cancellitis" is pointed out in a chapter devoted to "fifteen points on contracts and cancellations" of the new Credit Man's Diary and Manual of Commercial Laws for 1921, now being sent to members of the National Association of Credit Men, with branches in 130 cities. This volume is the product of a representative board of editors from the various states headed by William Walker Orr of New York City.

Some people do not know what constitutes the sale and purchase contract and as a consequence fail to start the sale right. This is one of the reasons for the easy cancellations that have been sweeping the entire country and which have resulted in more than $250,000,000 losses to American manufacturers, wholesalers and jobbers. This publication tells what to guard against; what to do to minimize the evil of cancelled orders and advises how to cut down losses.

The new $1 Treasury savings stamp will help you to accumulate a reserve fund. The 25c. thrift stamp is the children's way to a "success fund." Keep right at it!

Secondary Boycott Against Factory Products Illegal

A decision hitting at union labor activities was rendered on Jan. 3 by the Supreme Court of the United States in a case involving an injunction obtained by the Duplex Printing Press Co., of Battle Creek, Mich.

In the decision, which was written by Justice Pitney, it is held that the use of the secondary boycott against products of the factory was illegal. It is further held that provisions of the Clayton act designed to permit labor unions a certain degree of freedom are not broad enough "to become a cloak for an illegal combination or conspiracy in restraint of trade as defined by the anti-trust laws."

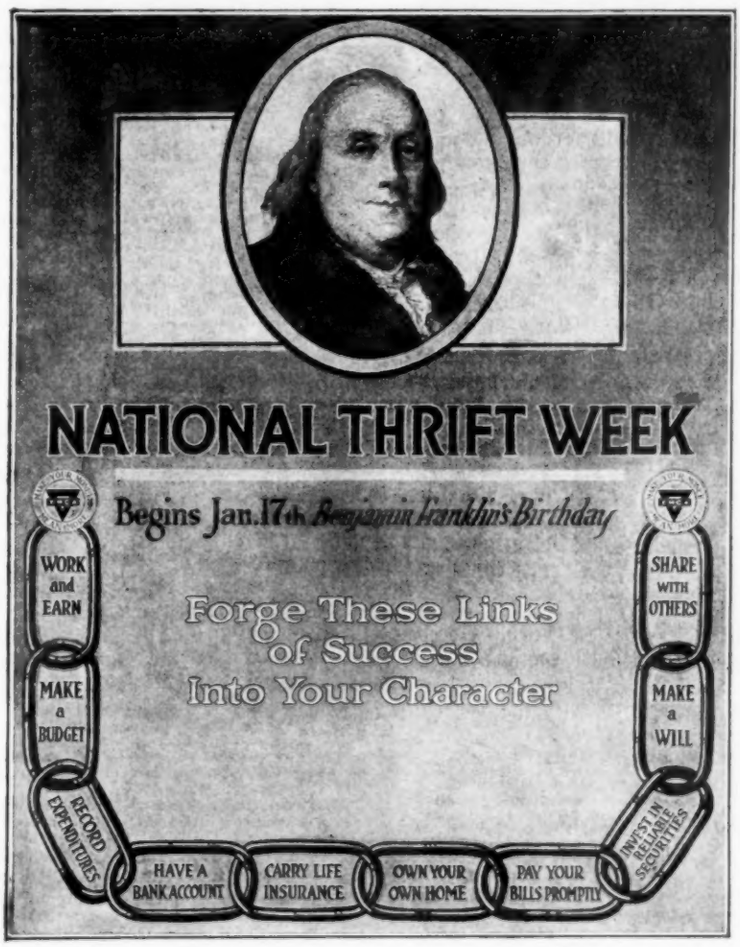
Justice Brandeis read a dissenting opinion. This was concurred in by Justices Holmes and Clarke. Justice Brandeis held that the acts complained of could be justified by self-interest and that it was not the province of the courts, but rather of legislative bodies to determine what acts might be in conflict with the rights of the community.

The case did not involve any acts at the factory of the company at Battle Creek, but a secondary boycott against products sold in New York. The Circuit Court of Appeals held in favor of the labor union. The Supreme Court has reserved that decision and held the issuance of the injunction to be justified.

The Duplex Printing Press Co. employs 200 machinists at its factory at Battle Creek. The company maintains an open shop and when a strike was called only eleven machinists and three others who superintend the installation of presses quit work. The company was enabled to continue operation with non-union men. The union then directed its effort toward a nation-wide boycott of its products. The acts of the union embraced a warning to customers that it would be better for them not to purchase from this company, or having purchased, not to install the presses, and threatening them with loss.

Justice Pitney in the majority opinion held that "by no fair or permissible construction" could acts contrary to anti-trust laws be considered as made permissible by the Clayton act.

Justice Brandeis said that he had come to the conclusion that both the common law of a state and a statute of the United States declare the right of



Federal District Court in the Southern district of New York issued an injunction against Emil J. Deering and William Bramley, business agents of the International Association of Machinists. industrial combatants to push their struggle to the limits of the justification of self-interest. He said that all rights are derived from the purposes of the society in which they exist and above all rights rises duty to the community. He declared it is not for judges to determine whether conditions exist causing danger to the community. He said "it is the function of the Legislature, which, while limiting individual and group rights of aggression and defense, may substitute processes of justice for the more primitive method of trial by combat."

In describing the history of the case Justice Brandeis said that there were in 1909 only four plants making large printing presses. By 1913 all of the plants except the Duplex had agreed to the eight-hour day, the minimum wage and other conditions demanded by the unions. The other plants then served notice that they would not agree so long as the fourth plant stayed out. The strike was called against the Duplex to bring that plant into line. Justice Brandeis held that the acts complained of did not constitute a secondary boycott, but were as much a primary boycott as was the strike called in the plant of the Duplex plant itself.

Philadelphia Foundrymen Meet

The 303d meeting of the Philadelphia Foundrymen' Association, Inc., was held at the Manufacturers' Club as usual on Wednesday evening, Jan. 12.

D. R. Yarnall, of Yarnall-Waring Co., maker of power-plant devices, Chestnut Hill, Philadelphia, who has just returned from Germany and Central Europe, where he had been doing relief work, gave a lantern-slide talk on what Germany has been doing since the armistice; how Germans are living, what they earn, what they eat and drink, the cost compared with our own; also their ability to procure coal and coke, raw material, etc., so as to make their goods for other countries as they did before the war; the great Krupp works, etc.

The election of officers for 1921 and the usual luncheon was served in the grill, following.

National Chamber of Commerce To Hold Ninth Annual Meeting in Atlantic City

Joseph H. Defrees, president of the Chamber of Commerce of the United States, announced today that the ninth annual meeting of the National Chamber will be held at Atlantic City, April 27, 28 and 29.

In announcing the time and place of the annual meeting, President Defrees let it be known that consideration had been given to New Orleans and Washington as likely cities in which to hold the meeting. New Orleans was eliminated because of the desire of the Chamber to hold the meeting in a place near Washington. Lack of hotel accommodations and suitable meeting quarters to seat the three or four thousand business men who will attend the meeting were the reasons for not selecting Washington.

The eighth annual meeting of the National Chamber also was held at Atlantic City.

Hoover Heads Move for Public Works

The Engineering Council, formed in 1917 to enable the engineers of the nation to aid in meeting the war emergency, passed out of existence on Jan. 1, 1921, when it was formally merged into the American Engineering Council of the Federated American Engineering Societies under the leadership of Herbert Hoover. The new council, representative of nearly 200,000 engineers, aims, says a statement authorized by Mr. Hoover and his associates, to voice the aspirations and ideals of the engineering profession, in whose behalf, and with the coming of the new year, it will carry on an active and comprehensive plan of public service.

J. Parke Channing, of New York, who has been chairman of Engineering Council since its formation, will be actively identified with the new council as vice-chairman. Other vice-chairmen who will aid Mr. Hoover in pushing the council's program of national advancement, social, economic and technical, are Calvert Townley of New York, William E. Rolfe of St. Louis and Dean Dexter S. Kimball of Cornell University.

Governmental efficiency will be one of the chief concerns of the American Engineering Council, which, it was announced, will continue the old body's campaign to bring about the establishment of a National Department of Public Works. The council has decided to co-operate with the National Public Works Department Association, which was organized as a result of the action of Engineering Council, and which has committees at work in every state.

The Washington headquarters of the association will be maintained. Adolph Lewisohn is chairman and James T. Grady, Director of the Department of Public Information at Columbia University, is secretary of the New York Committee of the Association. Senator Harding, according to a statement given out at the committee's headquarters, 71 Broadway, by Mr. Lewisohn, has assured the committee that he "is very much in favor of bringing together under one department all of the present agencies of public works now scattered around Washington."

The New York Committee has been furthering a nation-wide campaign for the passage of the Jones-Reavis bill for the creation of a department of public works by making over the Department of the Interior and changing its name. Many Republican leaders, including President Nicholas Murray Butler of Columbia, Senator Reed Smoot, Senator Medill McCormick, Governor Lowden of Illinois, Vice-president-elect Coolidge, favor the principle of the plan. Ex-Secretary Franklin K. Lane and Governor Cox take the same view.

The Smoot-Reavis reorganization resolution, passed by both houses of Congress, represents, according to the New York Committee, a broadening of the public works idea, whose original sponsor was Engineering Council. The new American Engineering Council will not confine its interest to the public works project alone, but will seek to promote economy and efficiency in all branches of the Government service.

"American Engineering Council," said a statement issued at the council's offices in the headquarters of the American Society of Mechanical Engineers, "recognizes the fact that the activities of the technical bureaus of the Federal Government are of fundamental importance in the development of our economic resources and recommends that great care and careful discrimination be exercised in any reductions that may be necessary."

The council has appointed a committee on public affairs with Mr. Channing as chairman. Mr. Hoover, as president of the council, has, it was announced, by direction of the council, appointed the present committees of Engineering Council. Among the committee chairmen are Col. William Barclay Parsons, chairman of the Board of Trustees of Columbia University, Military Affairs; Curricula of Engineering Schools, Dr. Alexander C. Humphreys, Stevens Institute, Hoboken; Patents, Edwin J. Prindle; National Public Works Department, F. T. Rubridge; New York State Government Reorganization, H. deB. Parsons; Water Conservation, Calvert Townley; Types of Government Contracts, Arthur P. Davis.

The council starts the year, it was announced, with an executive board of twenty-four members representing engineering societies in every industrial center. A call for a meeting of this board on Feb. 11 will be sent out in a few days. The meeting will be held either in New York or Washington.

One of the first acts in the council's plan of public service will be the appointment of a committee to investigate industrial waste. This committee, it was stated, will be the agency through which the council will deal with labor, chambers of commerce and other organizations in an effort to solve the problems of industrial relations.

Opposes Cut in Foreign Trade Appropriations

Appealing to Congress for increased appropriations for support of the Government Service of Trade Promotion and Trade Information, the National Foreign Trade Council declares that it is wise economy to spend money in proper ways that will promote commerce and thereby increase the Government revenues. The Council points out that 60 per cent of the revenues for 1919 come from successful commercial activities and that our foreign trade produced more than 13 per cent of the total revenues. The Council has sent to each member of the House of Representatives a leaflet entitled "A Square Deal for Our Foreign Trade," in which it makes a number of interesting statements regarding our international commerce and the extent to which it is promoted by private enterprise, as compared with Government support. The leaflet with the exception of its title, follows:

Every man, woman and child in the United States is vitally concerned in the maintenance of our foreign trade.

Seventeen per cent of our total production is devoted to foreign trade
One-fifth of our industrial and agricultural population depend for their livelihood on foreign trade.
Every industry exports some part of its finished products.
Most industries import essential raw materials.
The price of our agricultural products is determined by the laws of supply and demand in the markets of the world.
Certain imports are essential to the fertility and operation of our farms.
All parts of the United States, however distant from the seacoast, contribute directly or indirectly to our foreign trade.

Congress has never granted appropriations in support of the foreign service of our Government in any way commensurate with its importance or at all comparable with appropriations granted other services.

Our foreign commerce in 1919 amounted to $11,824,790,922.
As $916,510 was appropriated for the Bureau of Foreign and Domestic Commerce, and as approximately $1,880,505 of the State Department's appropriations were used solely to aid foreign commerce, the United States Government spent in promoting foreign trade only 2/100 of 1 per cent of the value of our exports and imports.
Our agricultural production in 1919 was valued at $24,982,000,000.
As the Department of Agriculture was granted $33,899,761 to aid agriculture the U. S. Government spent in promoting agriculture 13/100 of 1 per cent of the value of our agricultural products.
In proportion to their respective values therefore, Congress appropriated *six and one-half times* as much for agriculture as it did for foreign trade.
It was true economy to make these appropriations for agriculture. It delivered the goods.
It will be true economy to make similarly liberal appropriations for foreign-trade promotion. Foreign trade will deliver the goods.
In 1920 the Government devoted 93 per cent of its expenditures to payments upon wars, past, present and future.
Our foreign commerce produced more than 13 per cent of the total revenues of the Government in 1919, out of which these payments on account of war were made.
But the U. S. Government devoted to foreign trade promotion only 5/100 of 1 per cent of its total expenditures.

Private enterprise has done its full share in promoting our foreign trade.

Private concerns spend an average of 7 per cent in promoting their foreign trade.
Private concerns spent in 1919 a total of approximately $550,000,000 in promoting exports alone.
Therefore, private enterprise spent 180 *times* as much on exports alone as did the U. S. Government on both exports and imports.
Some private firms each spend more than does U. S. Government in promoting foreign trade

It is a legitimate function of government to carry on certain foreign trade promotions which cannot or should not be handled by private enterprise.

American business with foreign countries cannot be conducted without the assistance of the Consular Service or without protection by the Diplomatic Service
Private firms cannot obtain from official sources information which may be readily available to Commercial Attachés.
Government foreign service can collect information which small producers individually cannot afford to gather.
Government foreign service avoids duplication of effort in the collection of data of general interest.

There is no economy in diminishing the sources of our Government revenues.

Taxes on income and profits supplied 60 per cent of our Government revenues in 1919.

These taxes accrue only if our industries operate at a profit.
This profit depends on the maintenance of our foreign trade, which disposes of our 17 per cent surplus production to the best advantage.
Customs duties supply 3.6 per cent of our Government revenues.
These duties obviously depend on the maintenance of our imports.
The greater our foreign trade becomes, the greater will be the revenues based on profits and on imports.
The more Congress grants the Government Departments for constructive work which cannot be carried on by private enterprise the greater our foreign trade will become.

It is dangerous to weaken an organization when the strain upon it is greatest.

Our foreign trade is now faced by renewed foreign competition, with exchange everywhere unfavorable to our exports.
Foreign governments are reorganizing and increasing the government services which support their foreign commerce.
It is the part of prudence and of economy for the United States to do the same.

A. S. M. E. Forms Material-Handling Section

The American Society of Mechanical Engineers has formed a Material Handling section. About 700 members of the Society have been enrolled, although only a small part of the Society's membership has been formally notified of this professional section.

The executive committee of the section, consisting of R. M. Gates, chairman; H. V. Coes, Kern Dodge, Nathan C. Johnson and F. A. Wardenberg, has issued a statement saying that great potential interest has been aroused in the bringing together of individuals who desire to help in solving the handling problems of mining, transporting, manufacturing and distributing of all materials.

"It is the desire of the executive committee of the Material Handling section," the statement says, "before proceeding with a definite program, to consider all major phases of the subject in order that the work of the section can be made of the greatest possible benefit to the engineering profession, to industry and to the general public.

"Our members have expressed their interest in all broad phases of the great transportation problem which confronts industry: (1) How the mechanical engineers can improve machinery and equipment for the handling of materials; (2) how our great material handling costs can be reduced if the whole subject of transportation is analyzed and co-ordinated from the viewpoint of making economies over our present methods.

"The executive committee in its preliminary study of the proposed activities of this section, is considering the advisability of organizing committees, as required by the amount of work in the province of each, along two entirely separate lines: (1) According to types of material handling equipment, such as conveyors, cableways, cranes and the like; (2) according to industries which have material handling problems, such as steel manufacturers, storage warehouses, commodity distribution centers, construction work, automobile or tire industries and the like.

"It is the intent of the section to so thoroughly discuss the controlling factors in each line by meetings held by these various committees so as to develop better methods of handling materials and to standardize equipment and methods where the same are desirable.

"Other important work along research lines could be undertaken to build up, through the formation of specialized committees, certain classes of data and of information of general interest to others. The actual cost of handling materials at terminals, for example, the relation of the cost of handling material to the general costs in factory operation, the percentage of cost of commodities which merely represent transportation in its various phases.

"There is a wonderful opportunity for such research committees to be placed on subjects of national importance, such as the distribution of commodities. Such research would undoubtedly get at the heart of certain of our economic problems. Men could be found for these committees, in the judgment of the executive committee, who are the biggest men in the field, providing it was understood that the work of investigation would be of a non-political, non-commercial character and undertaken by engineers in the spirit of research for the benefit of the public, the industries and the engineering profession."

Workers Got Less Under Profit-Sharing System Than Normal Pay

More than twenty of the employees of the New Bern Iron Works and Supply Co., New Bern, N. C., who were among those to go out on strike when the system of income sharing adopted by the company at the suggestion of the employees resulted in a considerable decrease in their normal salaries, have returned to work accepting a wage scale of 70 cents an hour, which is a reduction of approximately 20 per cent under the previous scale.

The labor situation at the New Bern plant attracted national attention a few weeks ago when, following a proposal of the company for a second reduction of 10 per cent in the wage scale, the employees suggested a division of the profits after the manufacturing costs and the overhead expenses had been deducted.

The owners of the company adopted the suggestions retaining full control of the plant but giving the employees all of the profits. The pay checks for the first week under this plan showed that the division of the profits approximated the salary scale that had been proposed by the company. Thereupon the men went out on strike and the plant was closed down temporarily. It resumed operations when the twenty or more men returned to work, accepting the wage scale offered by the officials. It is expected that the others will return on the same basis—namely, seventy cents per hour.

C. H. Wills & Co. Causes Boom in Marysville

C. H. Wills & Co., Marysville, Mich., manufacturer of automobiles, has completed the first two units of its plant with a floor space of 448,000 sq.ft. The company expects to make deliveries of its motor cars in February.

Some time ago the company picked Marysville for its ideal physical characteristics and facilities for the manufacture of motor cars, and purchased 4,200 acres. It has arranged for houses for its employees; it built sewers, streets, two steamer piers and five miles of railroad sidings. In short, it made such improvements that today Marysville offers many attractions as a manufacturing center.

The officers of the company are: C. H. Wills, president; J. R. Lee, vice president; K. B. Alexander, vice president; Chas. Morgan, vice president; F. D. Stone, secretary; Frank P. Book, treasurer, and G. S. Anderson, assistant treasurer.

Machine-Tool Situation of Rockford, Ill.

The situation existing in the machine-tool and general manufacturing industries in Rockford, Ill., is much the same as that found in other localities. Business has been remarkably quiet for several weeks. Manufacturers here are taking a hopeful view of the situation and expect business to be more brisk as the spring season begins. Several of the large machine-tool builders of Rockford have other lines that are offshoots of the parent organizations, and these in all cases show a greater degree of activity. While not engaged to full capacity the latter can be used in a beneficial manner to hold the skilled labor organizations together.

A few of the machine-tool builders have seen fit to close their plants for a period of several weeks through the holidays and during the period of inventory. Some have not definitely decided upon a date for re-opening. Others who have not closed are operating at from 40 to 50 per cent of their capacity, and are doing this by running short hours in order to give work to a maximum number of mechanics. Nearly everyone reports a surprising number of inquiries that in many cases request early deliveries. However, the business continues to hang fire and it is impossible to get the customer to close definitely with an order. One machine builder who does considerable exporting reports that there is still a small volume of this business.

Auto Plants Reopen

The Buick Motor Co. resumed operations at Flint, Mich., on Jan. 11, giving employment to 12,000 men. The plant has been idle three weeks. Normally the company employs 18,000 men. Announcement also was made that the Champion Ignition Co., employing 2,000 men, has started operations.

Business Items

The Hazard Lead Works, Inc., of Hazardville, in Enfield, Conn., has voted to increase its capital stock from $50,000 to $100,000.

The Bridgeport Screw Co., of Bridgeport, Conn., will increase its capital stock from $500,000 to $1,000,000.

The Allan-Diffenbaugh Wrench and Machine Tool Co., Baraboo, Wis., which was incorporated recently, has started the manufacture of tools and wrenches in Baraboo, Wis.

A reorganization of the Tomahawk Steel and Iron Works of Tomahawk, Wis., has been effected. F. J. Callan, formerly vice president and general manager, has disposed of his interests, and is succeeded by William G. Bauman. Mr. Bauman was a salesman for the Scully Steel and Iron Works of Chicago for a number of years. William Dever and Lenore Larson were re-elected president and secretary respectively.

The Clarksville Foundry and Machine Works, Nashville, Tenn., has taken over the plant, equipment, and stock of the Drane Foundry and Supply Co. on Commerce Street. The firm will operate the Drane plant in addition to its old plant near the Red River Iron Works near Clarksville, Tenn.

The directors of the Wizard Check Endorser and Printing Machine Co., 457 Calvert Bldg., Baltimore, Md., have elected the following officers: President, F. S. Weise; vice president, R. Norman Cadle; secretary and treasurer, John H. Hessey. The board of directors elected is composed of the above officers and J. Norris McFarlane and George A. Wilson.

Geo. H. Olney & Co., 50 Church St., New York City, has announced the addition of a machine-tool division to its regular line of woodworking tools, engines, boilers, stacks, etc. C. F. Loretz, mechanical engineer, will be in charge of its power plant and B. E. Carpenter in charge of the iron and woodworking machinery department.

A general meeting and business session of its district managers and sales engineers will be held by the Pawling & Harnischfeger Co., Jan. 25 to 27. A general review of the past year's business will be discussed and plans for future sales in the various lines—cranes, hoists, excavating machinery and machine tools—will be outlined.

The Baird Machine Co., of Stratford, Conn., a suburb of Bridgeport, has increased the capital stock of the company from $500,000 to $1,200,000. The company manufactures machinery of various types.

Alexander Palmros, formerly engineer of the Pneumelectric Co. of Syracuse, N. Y., has established offices with his son, G. A. Palmros, at 445 South Warren Street. The partnership will practice in mechanical and electrical engineering and development of manufacturing processes.

With extensive iron-ore properties in Georgia, railroad and coal mining properties in several counties of Tennessee, the aggregate value of which exceeds $700,000, the Dayton Coal, Iron and Railroad Co., of Dayton, Tenn., has gone into the hands of a receiver.

The Whiting Foundry Equipment Co., Harvey, Ill., announces that it has changed its name to the Whiting Corporation, increasing its authorized capital stock from $700,000 to $3,000,000. The Whiting Corporation remains under the same management and will continue the manufacture of cranes, foundry equipment and railway specialties as heretofore.

A new corporation of Detroit capitalists, in company with M. Chester, an experienced mining engineer of Ellijay, Ga., has taken over the iron ore mines near Ellijay and extensive developments of the property are planned. The mines have lately been shut down but active operations have been again resumed. These mines produce a brown hematite ore of extra good quality.

The Southern Textile Exposition Co. has announced that arrangements are being made to hold a Southern products show in Greenville, S. C., Oct. 6 to 12, 1921. At this show all kinds of products manufactured in the industrial plants of the South will be exhibited, including mainly textile products, machinery and iron and steel products.

Barnes & Irving, dealers in machinist, tool and steel supplies in Syracuse, N. Y., has recently purchased a plot 200 x 150 ft. in the heart of Syracuse's industrial center, at West Fayette and Niagara Sts. for the erection of a warehouse to cost approximately $100,000.

The L. S. Starrett Co., Athol, Mass., distributed a bonus on Jan. 7 to its employees. The bonus ranged from 4 to 10 per cent on the amount of wages earned during the last six months, figured on the length of time each employee has been with the company.

The Chicago Pneumatic Tool Co., New York, announces the appointment Jan. 1, 1921, of R. F. Eissler as assistant to the vice president with headquarters in the company's new office building at 6 East 44th Street, New York. W. C. Straub, formerly district manager of the New Orleans branch, has been appointed district manager of the Pittsburgh branch to succeed Mr. Eissler; and Ross Wyeth, formerly attached to the Pittsburgh branch, has been appointed district manager of the New Orleans branch to succeed Mr. Straub.

The annual dinner and convention of the Harmony Club, sales organization of the J. M. & L. A. Osborn Co., Cleveland, Ohio, was held at the Hotel Cleveland, that city, on Jan. 12-13. About twenty-five members were present, district managers from Buffalo, Columbus, Adrian, Mich., and Binghamton, N. Y. attending.

Obituary

CHARLES H. ARMSTRONG, secretary and treasurer of the Armstrong Manufacturing Co., Bridgeport, Conn., manufacturer of tools, etc., died at his home here on Jan. 1 after an illness of one week with angina pectoris. Mr. Armstrong, who was nearly sixty-one years old, was born in Waterbury, Conn., Jan. 28, 1860, and came to Bridgeport when fifteen years of age. He has been secretary and treasurer of the Armstrong company for the past thirty-five years. Mr. Armstrong was also active in municipal affairs, having served on various city commissions.

JOSEPH SCHREIBER, 63 years old, civil and hydraulic engineer, died Jan. 5 at Johns Hopkins Hospital, Baltimore, from heart trouble. He had been ill about three weeks. In 1879 he became construction engineer of the St. Louis Water Works and went to Baltimore to supervise the erection of pumping machinery for the St. Louis plant. He remained in Baltimore and planned numerous important improvements. He also was at the head of the Suburban Gas Works, Baltimore, for some time.

Personals

GEORGE H. GRUNDY, for many years connected with the Crucible Steel Co., of America, was manager of its New York branch, is now associated with the Poldi Steel Corporation of America, New York as its general sales manager.

FELIX J. WASILKOWSKI has recently ben promoted from assistant to works manager to production and efficiency engineer of the Central Metal Products Corporation, College Point, N. Y., formerly the Empire Art Metal Co., Inc.

JOSEPH J. ZUMBERG has several connections with the Oesterlein Machine Company of Cincinnati and has taken a position as designer for the Cincinnati Grinder Co.

BRUNO C. LECHLER, formerly general manager for the S. S. Hepworth Co., of New York City, is now manager of the sugar machinery department of the Fletcher Works, Philadelphia.

FREDERICK G. KENYON, formerly chief checker in the tool drafting room of the Bullard Machine Tool Co., has resigned and is now instructor in mechanical and architectural drafting and machine design at the State Trade School, Bridgeport, Conn.

SOLOMON E. GILLESPIE, formerly assistant engineer of the Murray Co., Dallas, Tex., has opened an office as consulting engineer in Dallas.

HARRY P. MEREDITH, formerly manager of manufacturing of the Curtiss Aeroplane and Motor Corporation, of Garden City, L. I., and Buffalo, N. Y.,

has become connected with the Maxwell-Chalmers Motor Co., Inc., of Detroit, Mich., as general works engineer in charge of all building design, changes on construction, plant maintenance and power-plant operation for all of the company's plants in Detroit, Dayton, Ohio, Newcastle, Ind., and its Canadian plants.

FRANK L. EIDMANN, mechanical engineer of the Cowan Truck Co., Holyoke, Mass., makers of elevating trucks, tractor trucks, etc., has recently resigned. Previous to joining the Cowan organization, Mr. Eidmann was with the Heald Machine Co., of Worcester, Mass.

H. W. BLAKE, senior editor of the *Electric Railway Journal*, was given a dinner on Jan. 6 by his associates, as a tribute to his thirty years' of continuous service with that paper. As a tangible remembrance of the occasion, Mr. Blake's friends in the McGraw-Hill company presented him with a de luxe edition of Gibbon's "Decline and Fall of the Roman Empire."

New Publications

Compressed Air Plant. By Robert Peele, Mining Engineer and Professor of Mining in the School of Mines, Columbia University. Four hundred and eighty-five 6 x 9-in. pages, with many diagrams, illustrations and tables. Bound in cloth boards. Fourth edition. Published by John Wiley & Sons, Inc., New York, N. Y.

In this edition a new chapter has been added: Chapter XXVII on "Measurement of Air Consumption." It contains data on the flow of air through orifices and short tubes and a discussion of appliances for measuring air at both low and high pressure, including simple tank apparatus that can be readily improvised. A note has been appended to chapter XXV relative to some important air-lift work recently done at a large mine in Mexico. The third edition was reviewed in Vol. 50, No. 15 (April 10, 1919) of the *American Machinist*.

Automotive Ignition Systems. By Earl L. Consoliver, M.E., sometime assistant professor of mechanical engineering at the University of Wisconsin, and Grover I. Mitchell, B.S., assistant professor of mechanical engineering at the University of Wisconsin. Two hundred and sixty-two 6 x 9-in. pages, with three hundred and forty-five illustrations and diagrams. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y.

This volume furnishes a comprehensive, systematic course of study dealing with the ignition systems used on automobiles, tractors, trucks and airplanes. It will be found to be of real value to men who install, adjust and repair ignition systems and to the automobile owner who wishes to understand the principles and construction of modern ignition systems. Many well-known systems are described and illustrated and wiring diagrams are given.

The following chapter headings will serve to indicate the extent of the field covered and the order of presentation: Principles of Electricity and Magnetism; Ignition Batteries; the Jump-spark Ignition System; Modern Battery Ignition Systems; Battery Ignition Systems for Multiple Cylinder Engines; the Low-tension Magneto; Modern High-tension Magnetos—Armature Types; Modern High-tension Magnetos—Induction Types; Care and Repair of Ignition Apparatus; Ignition Troubles and Remedies.

Straight Business in South America. By James H. Collins. Two hundred and eighty-five 5 x 8-in. pages, cloth boards. Published by D. Appleton & Co., New York City.

The impression given by reading this volume is that the author is well qualified to write on his subject and that he has given facts. The book gives definite information necessary to establishing and maintaining business in South America. The material was drawn entirely from Argentina, Brazil, Chile, Uruguay and Peru, being obtained by the author during an eight months' tour, resulting in a series of articles for the *Philadelphia Public Ledger*, from which his book has been the outgrowth. Some of the material appeared in other publications.

The following typical chapter titles indicate very clearly the contents of the book: Wanted—Business Imagination for Export; What South America is Like; What the People and the Countries are Like; The Tools of the Trade—Our Own Banks, Our Own Ships, Investments, Distribution, American Retailing, American Consumer Advertising; Doing Business with South America; The Other Fellow—Our Competitor; What Do South Americans Think About Yankees? The Importance of Buying as Well as Selling; What Chance for Me in South America? What You Will Need in South America.

The Essentials of Descriptive Geometry. By F. C. Higbee, M. E., Professor and head of Department of Descriptive Geometry and Drawing, State University of Iowa. Third edition, revised. Two hundred and eighteen pages; 6 x 9 in.; 156 figures; 302 problems. Published by John Wiley & Sons, Inc., New York, N. Y.

The book is intended chiefly to serve as a foundation for mechanical drawing, the aim of the author being to include only those portions of descriptive geometry which possess industrial utility and which develop the qualities of mind essential in a draftsman. The order of the material is somewhat different than that usually employed, although the development is logical and should be effective. The book is well made up with regard to such matters as sub-heaings and the placing of illustrations. Problems relating to the work are inserted at the ends of chapters. The chapter on model-making is worthy of special note. In an illustrated appendix are given various geometrical constructions which can be made use of in solving the problems.

An idea of the scope of the work can be gotten from a survey of the list of chapter headings, which follows: Orthographic Projection; Profile Plane; Assumption of Points and Lines; Planes; Location of Points, Lines and Planes; Revolution of Points; Problems on the Line; Problems on the Plane; Problems on Angles; Problems on Points, Lines and Planes; Surfaces; Plane Surfaces, Cylndrical Surfaces; Conical Surfaces; Intersection of Surfaces Surfaces of Revolution; Warped Surfaces; Tangent Planes and Lines; Model Making.

How to Keep Invention Records. By Harry A. Toulmin, Jr. Eighty-five 5 x 8-in. pages; illustrated by 12 form diagrams. Bound in brown cloth boards. Published by D. Appleton & Co., New York.

The author emphasizes the necessity of protecting inventions, generally termed patents, trade marks and copyrights, by keeping records of them. He presents a practical method of insuring recording of dates in a series of twelve forms. The last chapter deals with the methods of patent investigations.

Trade Catalogs

Pumps. Taber Pump Co., Buffalo, N. Y. This folder illustrates and briefly describes the company's pumps for oils, gasolines and other clean fluids.

Steel Hoists, Hand Cranes and Steel Trolleys. Wright Manufacturing Co., Lisbon, Ohio. Catalog No. 10, pp. 47, 6½ x 9½ in. This catalog gives descriptions and illustrations of the "Wright" steel hoists, hand cranes and steel trolleys; the price list is also included.

P. & H. Chronicle. Pawling & Harnischfeger Co., Milwaukee, Wis. Booklet, pp. 58, 5 x 7½ in. This booklet sketches the company's history and is profusely illustrated with photographs of the personnel, the different departments and their products.

Cutler-Hammer Catalog. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. This company has issued in pad form a catalog containing prices and dimensions of its electric controlling apparatus.

Cushman Chucks. The Cushman Chuck Co., Hartford, Conn. Catalog for 1921, fifty 4 x 7-in. pages. Describing various types of Cushman chucks, including the parts of the chuck and other attachments. Specifications, tables of operations and price lists of replacement parts are included.

Ross Heaters. Ross Heater and Manufacturing Co., Inc., Buffalo, N. Y. Catalog F, pp. 39, 6 x 9 in. This catalog illustrates and describes the various types of heaters, condensers, expansion joints, coolers and Airjector pumps which this company makes.

Cranes. Milwaukee Electric Crane and Manufacturing Co., Milwaukee, Wis. Catalog, pp. 48, 7½ x 10¾ in. This company has issued a new 48-page catalog illustrative and descriptive of its complete line of cranes. The last page gives a partial list of the purchasers of the "Milwaukee Crane."

Thread Milling Machines. Smalley-General Co., Inc., Bay City, Mich. This is a revised eight-page circular showing illustrations and brief description of the Smalley-General No. 1 thread milling machine, No. 1C thread milling machine with power traverse and Smalley-General No. 4 thread milling machine.

Burrows Defectoscope and Magnetic Analyzer. Holz & Co., Inc., 17 Madison Ave., New York. Bulletin No. 41, pp. 20, 7½ x 10½ in. This bulletin describes the Burrows defectoscope and magnetic analyzer which is used for the inspection of steel rails, rods, wire, cable and all other steel and iron stock of uniform section.

La France Safety Devices, Edition D. American La France Fire Engine Co., Inc., Elmira, N. Y.

"And the end is that the workman shall live to enjoy the fruits of his labor; that his mother shall have the comfort of his arm in her age; that his wife shall not be untimely a widow; that his children shall have a father, and that cripples and helpless wrecks who were once strong men shall no longer be a by-product of industry."

Starting off with the above quotation from Juhnke, the catalog gives a complete summary of La France safety products.

Forthcoming Meetings

The Cleveland Section of the American Society of Mechanical Engineers will hold a meeting in the Cleveland Engineering Society's Rooms on Feb. 1. R. R. Abbott, of the Peerless Motor Car Co., will speak on the "Uses of Alloy Steel in the Machine Tool Industries."

The Society of Automotive Engineers will hold a meeting in Chicago on Feb. 2 at the Hotel Morrison in connection with the Chicago Automobile Show; also one in Columbus on Feb. 10 at the Winter Garden, New South Hotel, in connection with the Tractor Show.

The Engineering Institute of Canada will hold its thirty-fifth annual meeting in Toronto, King Edward Hotel, on Feb. 1, 2 and 3.

The National Civic Federation will hold its twenty-first annual meeting at the Hotel Astor, New York City on Feb. 14, 15 and 16, to discuss International, European and American labor problems.

The National Foreign Trade Council will hold its eighth annual convention in Cleveland, Ohio, on May 4, 5, 6 and 7. J. G. Hammond, care of the Council, 409 Park Bldg., Cleveland, is secretary.

A triple convention of the National Supply and Machinery Dealers' Association, the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association will be held in Atlantic City, N. J., May 16, 17 and 18, 1921, with headquarters for all three associations at the Marlborough-Blenheim. F. D. Mitchell, 4106 Woolworth Building, New York, is secretary of the last-named association.

The Spring Convention of the National Machine-Tool Builders' Association will be held on Thursday and Friday, May 19 and 20, at Hotel Traymore, Atlantic City, N. J. The general manager is Ernest F. DuBrul, 817-818 Provident Bank Building, Cincinnati.

The Industrial Cost Association will hold a meeting, to organize a New York section, in the rooms of the A. S. M. E., 239 West 39th St., New York City, on Jan. 20, at 8 o'clock.

Condensed-Clipping Index of Equipment

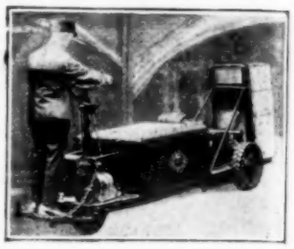
Patented Aug. 20, 1918

Grinding Machine for Broaches
J. N. Lapointe Co., New London, Conn.
"American Machinist," Dec. 23, 1920.

The capacity of the machine is ample to grind broaches 64 in. long and 8 in. in diameter. The grinding wheel is carried on a spindle supported by a swiveling-head, which makes it possible to grind both the rake angle on the back of the broach teeth and to undercut the faces. The head swings on the column of the machine to any angle in the horizontal plane and so permits the grinding of teeth at any angle to the axis of the broach. The machine occupies a floor space of 39 x 164 in.

Truck, Malleable Pot, Electric
Elwell-Parker Electric Co., Cleveland, Ohio
"American Machinist," Dec. 23, 1920.

The truck is intended for conveying the pots from the foundry and to the rattlers after the heating, as well as for charging the ovens or furnaces. The capacity of the truck is 4,000 lb., the pots being mounted on stools, so that the forks at the front end of the machine can fit underneath them. The toggle lifting mechanism is driven by a series motor through worm gearing and a special clutch. By means of the switch, the forks and the pot may be stopped at any point in the up or down travel. The lifting mechanism is completely inclosed and runs in oil. The overall length of the truck is 12 ft., and the weight with the battery is 3,600 lb.



Riveter, Truck-Frame
Baird Pneumatic Tool Co., Kansas City, Mo.
"American Machinist," Dec. 23, 1920.

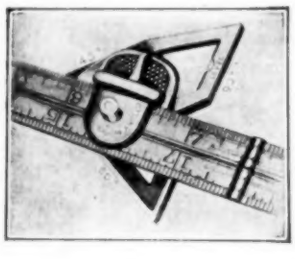
This device is adaptable to any steel fabrication within its range where the work is suspended from above and worked to completion from that position. The riveter itself is rigidly mounted on a stand. The sliding valve is controlled by two pedals, thus leaving the hand of the operator free to guide the work to its proper place. The riveter drives and heads ⅞-in. rivets, hot. It occupies little space, being but 38 in. high and weighing approximately 600 lb.

Controller, Clapper-Type
Allen-Bradley Co., Milwaukee, Wis.
"American Machinist," Dec. 23, 1920.

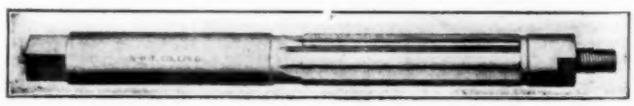
The controller, made in sizes ranging from 1 to 150 hp., is known as the "clapper-type controller," primarily because all switching and contact-making are done with a clapper-switch contactor. It is made for either alternating or direct current. The frame is constructed of steel, with pressed-steel inclosing covers. The controller is said to have advantages by virtue of the simple wiring and switch gear and the use of the compression resistor. Under-lever control gear, limit switch, brake connections and inclosing covers for the resistor compartment can be furnished.

Angler, "Arrow"
Barnes & Irving, Inc., Syracuse, N. Y.
"American Machinist," Dec. 23, 1920.

The device is intended primarily for attachment to a straight-edge or a folding rule, being small enough to fit in the pocket conveniently. It is stated that it does not deface the rule and can be quickly attached and adjusted. The device can be used for such purposes as a T-square, try-square, depth gage or scratch gage. It is said to form a quick means of laying out or finding angles, of bisecting angles, or of finding centers, diameters or tangents of circles. It is made of light-weight, non-corrosive metal.



Reamer, Hand, Expansion, "Rex"
Schellenback-Hunt Co., Cincinnati, Ohio
"American Machinist," Dec. 23, 1920.



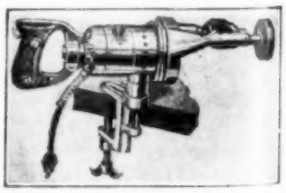
The reamers are split clear through the lengths of the teeth and are thus expanded at the starting ends of the cutters and not in the center only. The expanding screw is taper threaded and engages tapped threads near the starting end of the reamer. The ends of the teeth are ground at an angle and are locked after adjustment by means of a beveled locknut as shown. The construction permits of a wide range of expansion of the cutters—0.025 in. or more is easily obtainable in a ½-in. reamer, with corresponding increase in the larger sizes. The adjusting screw and locknuts are hardened.

Drilling Machine, Semi-Automatic, Five-Spindle (Changed Design)
Detroit Machine Tool Co., 1487 St. Antoine St., Detroit, Mich.
"American Machinist," Dec. 23, 1920.

The chief new feature of the machine lies in the clutch in the feed machanism contained in a housing on the right of the machine. The long, horizontal rod to be seen below the work tray is used to actuate a jaw clutch, so as to engage or disengage the worm drive in the feed. The type of work-holding fixture shown has a V-shaped jaw and a standard machine handle, although it is essentially the standard fixture No. 6100. It is intended for holding either hexagon or round stock from ¼ to 1¼ in. in diameter, as when drilling cotter-pin holes in screws and bolts.

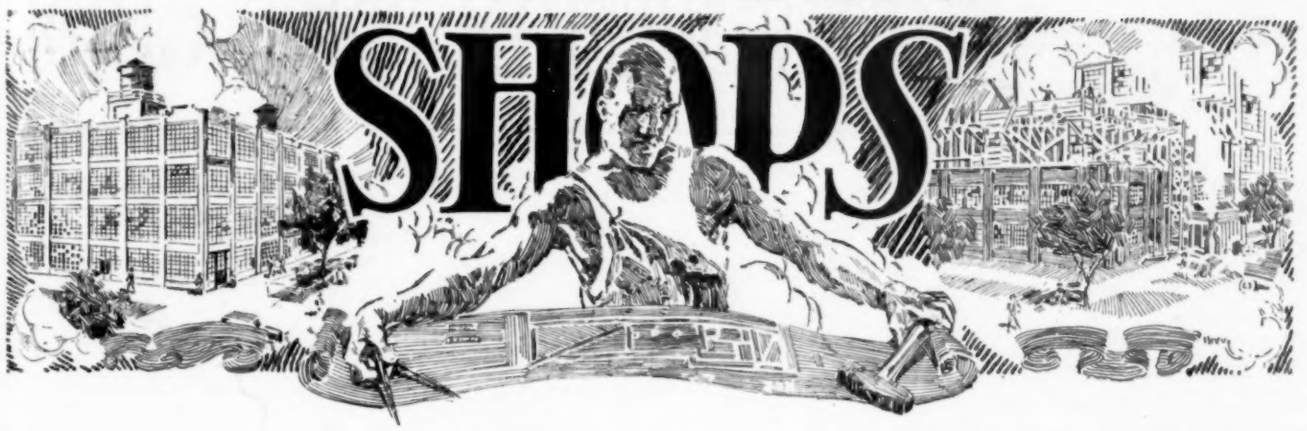
Attachment, Grinder, for Portable Drill
Arnold Electric Tool Co., Inc., New London, Conn.
"American Machinist," Dec. 16, 1920.

This attachment is recommended for the company's type-B portable electric drill. The frame carrying the wheel spindle is clamped to the body of the drill, a belt running on the sleeve of the chuck transmitting the power to the spindle. The tool can thus be used as a portable grinder, or it becomes a small bench grinder by clamping in position by means of a bracket, as shown in the illustration. The use of the attachments is said to greatly increase the field of application of the tool.



Clip, paste on 3 x 5-in. cards and file as desired

NEW *and* ENLARGED



Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

N. Y., Albany — The Simmons Machine Co., 981 Bway.—two spindle tapping machine for work on cast iron pipe flanges.

N. Y., New York (Borough of Manhattan) —The Chicago, Rock Island & Pacific Ry., 66 Bway.—one improved style 5-A pipe bending machine.

N. Y., New York (Borough of Manhattan) —V. Lowener, 114 Liberty St.—several special machines for finishing work on automobile motors.

N. Y., New York (Borough of Manhattan) —L. Schlesinger & Co., 64 Wooster St.——one spinning lathe with oval chuck and 12 in. swing.

N. Y., New York (Borough of Manhattan) —R. Snider, 2001 Grand Concourse—
Five No. 79, two No. 78 and two No. 77 Toledo geared presses or equivalent.
One No. 666 Toledo embossing press or equivalent.
One 2½ in. Gridley automatic mult. spindle.
One No. 22A New Britain automatic mult spindle, (used).

Pa., Harrisburg — The Harrisburg Machine Electric Welding Co., 43 North 18th St.—machine tools.

Pa., Philadelphia — E. McDevitt, 5212 Woodland Ave.—small lathe for auto repairs work.

Pa., Philadelphia — The Philadelphia Navy Yard—Armstrong tool holders and drill press vices.

W. Va., Logan — The Guyan Machine Shops—B. Shell, Purch. Agt.—Large back geared shaper.
Radial drill; motor driven, 220 volt, 3 phase, 60 cycle.
Punch and shear.
Bending rolls.
Round steel and shafting, 4-16 in. in diameter.
Lathe chucks, 2 jaw for light work.

Mich., Ann Arbor—The Ann Arbor Metal Products Corp. — miscellaneous equipment for making bronze blans.

Mich., Detroit — Schwartz Upholstering Co., 205 Moffat Bldg.—Medium sized lathe and drilling machine.

Mich., Detroit—The Steere Eng. Co., Box 43, North End Sta.—one squaring shear, having capacity to take plates of 100 in. x ¾ in., motor driven, 440 volts, 60 cycle, (used).

Mich., Lansing—The Michigan Brass & Iron Wks., Depot St., T. E. Hackett, Genl. Mgr.—miscellaneous equipment for making and machining castings.

Mich., River Rouge—Whitehead & Kales Co., (iron and steel workers)—pipe threading machine, power driven for cutting 3 in. pipe and smaller.

O., Youngstown—The Bd. Educ., 16 West Wood St.—equipment for metal and wood working shop.

Wis., Baraboo—F. and C. Goolmar, manufacturers of patented sectional tubular frames—additional equipment.

Wis., Milwaukee—The Natl. Blowpipe & Ventilating Co., 489 12th St.—F. Goethel Purch. Agt.—sheet metal working machinery.

Wis., Milwaukee — Sprecher Mfg. Co., 1910 Fond du Lac Ave.—P. W. Sprecher, Purch. Agt.—automatic screw machine.

Wis., West Allis — Allis Chalmers Mfg. Co., A. E. Bateson, Purch. Agt. — special machinery, also small tools for the manufacture of farm tractors.

Machinery Wanted

Mich., Negaunee—The Oliver Mining Co. —5 locomotive cranes.

O., Cleveland—The Fairmount Creamery Co., Bolivar Rd. east of East 4th St.—equipment for the manufacture of dairy products.

O., Cleveland — The Last Long Hoisery Co., 1375 West 6th St., M. I. Roth, mgr.—knitting machinery.

O., Forest—J. Herzog & Son, J. Herzog, Purch. Agt.—one 100 x 30-36 ft. stone elevator, one heavy duty pan crusher feeder, bin gates, chutes, etc.

O., Warrensville—The City Farms, Warrensville Rd.—wood-working machinery.

Wis., Milwaukee — The Milwaukee Bag Co., 206 South Water St.—manufacturer of burlap bags, etc., monorail crane.

Wis., Milwaukee—The South Side Wet Wash Laundry, 641 15th Ave., laundry equipment.

Metal Working

NEW ENGLAND STATES

Conn., Newington—The Amer. Mchy. & Equipment Co., will build a 2 story, 36 x 40 ft. factory for the manufacture of tractors and machinery.

Conn., Norwalk — The Amer. Insulator Co., New Freedom, Pa., is having plans prepared for the construction of a 2 story factory on Main St., here. E. A. Barth, New Freedom, engr.

Conn., Norwich—The Standard Oil Co., 26 Bway., New York City, has awarded the contract for the construction of a 1 story, 50 x 80 ft. garage on Forest St., here. Estimated cost, $15,000.

Conn., Stonington—Mystic Auto Station, Inc., East Main St., Mystic, will build a 1 story, garage, etc., here. Estimated cost, $15,000.

Mass., Allston (Boston P. O.)—The T. L. Harkins Machine Co., 44-54 Farnsworth St., Boston, has awarded the contract for the construction of a 2 story, 50 x 100 ft. plant on Cambridge St., here, for the manufacture of special machinery.

Mass., Cambridge—The Barth Press, 28 Oliver St., Boston, has awarded the contract for converting a 5 story factory on Massachusetts Ave. and Windsor Sts., here, into a printing plant. Estimated cost, $25,000. Noted July 1.

Mass., Lynn—The General Electric Co. will soon award the contract for the construction of a 4 story, 76 x 125 ft. addition to Bldg. 74. Estimated cost, $175,000.

Mass., Pittsfield — W. G. Boudreau, 34 Wilson St., is having plans prepared for the construction of a 1 story garage. Estimated cost, $15,000. Private plans.

Mass., Springfield — The Chaplin Realty Co., 374 Main St., will build a 1 story, garage on Water St. Estimated cost, $35,000.

Mass., Springfield — J. Freedman, 80 Greenwood St., will build a 1 story, 80 x 160 ft. garage, on Church and North Sts. Estimated cost, $25,000. Noted Sept. 2.

Mass., Springfield—M. Groth, 43 Church St., will build a 1 story, 50 x 52 ft. garage. Estimated cost, $15,000.

R. I., Providence—The Gilbane Building Co., 96 Harris Ave., will build a 1 story, 100 x 100 ft. garage on Ople St.

MIDDLE ATLANTIC STATES

Md., Baltimore—The Baltimore Car & Fdry. Co., Curtis Ave. and Locust St., has had plans prepared for the construction of two 1 story additions to its plant. Estimated cost, $18,000.

N. Y., New York (Borough of Manhattan) —The Ria Constr. Co., c/o G. H. Van Auken, archt., 1269 Bway., has awarded the contract for the construction of a 2 story, 100 x 100 ft. garage, at 841 10th Ave. Estimated cost, $75,000.

Pa., Bellwood—The Natl. Steel Constr. Co., 237 4th Ave., Pittsburgh, has purchased the plant of the Bellwood Eng. Co., here, and will enlarge and equip same for the manufacture of electrical equipment for the production of fabricated steel plates. S. Kakorski, Mgr.

Pa., Clearfield—Kurtz Bros., 2d St., are having plans prepared for the construction of a 2 story, 50 x 160 ft. addition to its present printing establishment, and newspaper and school supplies manufacturing plant, on 4th and Reed Sts. Estimated cost, $75,000. Hersh & Shollar, Commerce Bldg., Altoona, Archts.

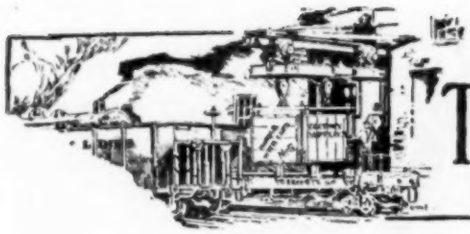
Pa., Darmont—The R. I. M. Motor Serv. Corp., Pittsburgh, has awarded the contract for the sonstruction of a 2 story, 89 x 107 ft. garage on Tennessee Ave., here. Estimated cost, $50,000.

Pa., Philadelphia—The Apex Hosiery Co., Lawrence and Luzerne Sts. is having plans prepared for the construction of a 5 story, 92 x 110 ft. addition to its factory. Private plans.

Pa., Philadelphia — The General Baking Co., 45 East 17th St., New York City, has awarded the contract for the construction of a 1 story, 80 x 104 ft. garage, on Reed and Percy Sts., here. Estimated cost, $15,000.

Pa., Philadelphia—J. G. McIlvain & Co., 58th and Woodland Sts., has awarded the contract for the construction of a 1 story, 30 x 122 ft. garage.

Pa., Philadelphia—A. Mignatti, 321 Duncannon St., will build a 1 story, 100 x 125 ft. garage on 2d and Clarkson Sts. Estimated cost, $20,000. Noted Jan. 1.



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern	$44 50	$36.60
Northern Basic	40 00	34.00
Southern Ohio No. 2	42 00	36 55
NEW YORK—Tidewater Delivery		
2X Virginia (Silicon 2.25 to 2.75)	51 26	39 40
Southern No. 2 (Silicon 2.25 to 2.75)	48.26	41.40
BIRMINGHAM		
No. 2 Foundry	40 50	33.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	42 50	38 10
Virginia No. 2	46 25	39.10
Basic	38 25	34.60
Grey Forge	40 25	34.60
CHICAGO		
No. 2 Foundry local	40 00	36 25
No. 2 Foundry, Southern	46.66	38 00
PITTSBURGH, Including Freight Charge from Valley		
No. 2 Foundry	41 96	28 15
Basic	38 00	34 40
Bessemer	38.00	35 40

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.80	$3.80	$3.47	$3.58	$3.62	$3.58	$3.47
Soft steel bars	3.70	3.70	3.52	3.34	3.52	3.48	3.52
Soft steel bar shapes	3.70	3.70	3.52	3.48	5.50	3.48	3.52
Soft steel bands	4.65	4.65	4.22	6.25			
Plates, ¼ to 1 in. thick	4.00	4.00	3.67	3.78	3.82	3.78	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$3.50
Warehouse, New York	4.75	3.52
Warehouse, Cleveland	3.52	3.42
Warehouse, Chicago	4.12	3.52

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
Blue Annealed					
No. 10	3.55	4.90	5.50–6.00	5.00	4.68
No. 12	3.60	4.95	5.56	5.05	4.83
No. 14	3.65	5.00	5.92	5.10	5.03
No. 16	3.75	5.10	6.02	5.20	5.13
Black					
Nos. 18 and 20	4.20	5.80	6.80–7.80	5.60	5.80
Nos. 22 and 24	4.25	5.85	6.85–7.85	5.75	5.85
No. 26	4.30	5.90	6.90–7.90	5.80	5.90
No. 28	4.35	6.00	7.00–8.00	5.90	6.00
Galvanized					
No. 10	4.70	6.40	6.50	6.25	5.30
No. 12	4.80	6.50	6.60	6.35	5.40
No. 14	4.80	6.50	6.60	6.35	5.40
Nos. 18 and 20	5.10	6.75	6.90	6.65	5.70
Nos. 22 and 24	5.25	6.90	7.05	6.80	5.85
No. 26	5.40	7.05	7.20	6.95	5.0
No. 28	5.70	7.35	7.50–9.00	7.25	6.00

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.80	$4.84
Flats, square and hexagons, per 100 lb. base	6.00	6.30	5.34

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound any quantities, f.o.b. Bayonne, N. J.

Nickel		Monel Metal	
Ingot and shot	43	Shot and blocks	35
Electrolytic	45	Ingots	38
		Sheet bars	40
		Hot rolled rods (base)	42
		Cold rolled rods (base)	56
		Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, grades "A" and "C" (base)	72
Copper nickel ingots	42
Hot rolled copper nickel rods (base)	52
Manganese nickel hot rolled (base) rods "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o.b. New York: 5/32, 8½c. per lb.; ⅛, 8c.; 5/32 to ¼, 7½c. Domestic iron sells at 1 2c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	7.00	12.00
Coppered bessemer rods	9.00	8.00	7.00
Hoop steel	4.65	4.04	4.43
Cold-rolled strip steel	9.50	8.25	9.25
Floor plates	5.75	4.00	6.28

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜ to 3	54–57½%	41½–44%	¼	15½–25½%	+11–11½%
			⅜	19½–29½%	1½–11½%
			½ to 1¼	24½–34½%	8–18½%

LAP WELD

2	47–50½%	34½–38%	1¼		
2½ to 6	50–53½%	37½–41%	1½		
7 to 12	47–50½%	33½–37%	2	20½–28½%	6½–14½%
13 to 14	37½–41%		2½ to 6	22½–30½%	9½–17½%
15	35–38½%		7 to 12	19½–27½%	6½–14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅜ to 1½	52–55½%	39½–43%	⅜ to 1½	24½–34½%	9½–19½%
2 to 3	53–56½%	40½–44%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45–48½%	33½–37%	1¼		
2½ to 4	48–51½%	36½–40%	1½		
4½ to 6	47–50½%	35½–39%	2	21½–29½%	8½–16½%
7 to 8	43–46½%	29½–33%	2½ to 4	23½–31½%	11½–19½%
9 to 12	38–41½%	24½–28%	4½ to 6	22½–30½%	10½–18½%
			7 to 8	14½–22½%	2½–10½%
			9 to 12	9½–17½%	5½–+2½%

Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅜ to 3 in. steel butt welded	44%	28%	42½%	33½%	57½%	44%
2½ to 6 in. steel lap welded	39%	24%	44½%	29½%	53½%	41%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.00	15.00	19.00
Tin in 5-ton lots	34.25	35.25	59.00
Lead	5.37½	5.75	7.875
Zinc	7.00	7.00	9.25
ST. LOUIS			
Lead	5.25	6.25	7.50
Zinc	6.75	6.75	8.875

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

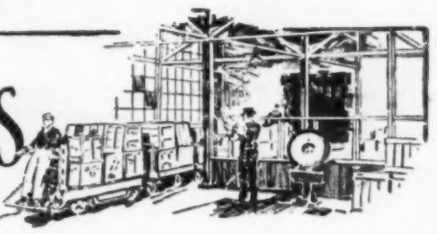
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	21.50	22.50	28.50	21.50	29.50	26.50	35.00
Copper wire (carload lots)	17.00	17.00	28.00	19.00	28.50	24.00	26.00
Brass sheets	20.25	20.25	25.50	24.00	28.00	30.00	26.00
Brass pipe	25.00	25.00	30.50	23.00	34.00	23.25	37.00
Solder (half and half) (case lots)	27.75	27.25	35.00	29.00	35.90	21.00	38.59

Copper sheets quoted above hot rolled 24 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 1000 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	18.25	22.75
New York	18.25	24.00
Cleveland	20.00	28.00
Chicago	21.25	25.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill — less 8% for carload lots 11.50

	Warehouse —In Casks— Current	Warehouse —In Casks— One Year Ago	Warehouse — Broken Lots — Current	Warehouse — Broken Lots — One Year Ago
Cleveland	15.30	11.50	14.70	12.00
New York	14.00	13.00	14.50	13.50
Chicago	14.50	15.00	14.95	15.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	6.25	9.50–9.75
Chicago	6.25	10.00
Cleveland	7.50	11.625

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	*New York Current	*New York One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	11.50	18.00	10.00	10.50
Copper, heavy, and wire	11.00	17.50	9.50	10.00
Copper, light, and bottoms	9.00	15.75	9.00	9.00
Lead, heavy	4.00	7.00	4.00	4.00
Lead, tea	3.00	5.00	3.00	3.50
Brass, heavy	7.00	9.00	7.00	10.00
Brass, light	5.50	8.00	5.00	5.50
No. 1 yellow brass turnings	6.00	9.50	5.50	5.50
Zinc	4.00	6.75	3.00	4.25

*These prices nominal because of dull market

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	29.00	26.00	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	28.00	34.00
Chicago	24.50	28.00
Cleveland	22.00	31.00

BABBITT METAL—Warehouse price per pound:

	—New York— Current	—New York— One Year Ago	—Cleveland— Current	—Cleveland— One Year Ago	—Chicago— Current	—Chicago— One Year Ago
Best grade	70.00	90.00	43.00	68.50	40.00	60.00
Commercial	30.00	50.00	14.50	17.25	9.00	15.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from 16.00 to 20.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	—New York— Current	—New York— One Year Ago	— Cleveland — Current	— Cleveland — One Year Ago	—— Chicago —— Current	—— Chicago —— One Year Ago
Hot pressed square	+$3.00	List	List net	$1.00	+1.15	1.45
Hot pressed hexagon	+ 3.00	List	List net	1.00	+1.15	1.45
Cold punched hexagon	+ 5.00	List	List net	1.00	+1.15	1.05
Cold punched square	+ 5.00	List	List net	1.00	+1.15	1.05

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	70–5%
Chicago	40%	50%
Cleveland	50%	60–10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	25%	50%	40%
Larger and longer up to 1½ in. by 30 in.	25%	40%	30%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $2.00 Cleveland..... $3.00 Chicago..... $2.50

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+15%	40%	25%
Larger and longer up to 1 in. by 30 in.	+15%	35%	25%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets Current	Rivets One Year Ago	Burs Current	Burs One Year Ago
Cleveland	25%	30%	10%	30%
Chicago	net	20%	net	20%
New York	40%–5%	30%	net	10%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	35%	50%	30%
Tinned	35%	50%	30%

Structural, same sizes:
New York..... $5.50 Chicago..... $5.75 Pittsburgh..... $4.50

Boiler, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.85 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	25.00	27.00	29.00
Brass	24.00	24.00	28.00

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1 c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.60 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	7.50@13.00	13.00	15.00	15.00@17.00
Colored mixed	7.00@11.00	9.00–12.00	11.00	11.00@13.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00	$2.00	$2.25
Philadelphia	2.75	2.75	2.00
Cleveland	4.00	3.00	2.50
Chicago	2.25	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.50	$3.50	$3.40
Philadelphia	3.65	3.65	4.625
Chicago	4.00	3.85	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Current	One Month Ago	One Year Ago
Prompt furnace	$5.00@$5.50	$6.00@$7.00	$6.00@$7.00
Prompt foundry	6.25@7.00	7.00@8.00	6.00@7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	—New York— Current	—New York— One Year Ago	—Cleveland— Current	—Cleveland— One Year Ago	—Chicago— Current	—Chicago— One Year Ago
Raw in barrels, (5 bbl. lots)	$0.83	$1.90	$0.95	$2.00	$0.94	$1.77
5-gal cans	0.90	2.10	1.20	2.25	1.19	1.97
1-gal cans (6 to case)	1.05					

WHITE AND RED LEAD—Base price per pound:

	Red Current Dry	Red Current In Oil	Red One Year Ago Dry	Red One Year Ago In Oil	White Current Dry and In Oil	White One Year Ago Dry and In Oil
100 lb. keg	14.00	15.50	14.50	15.50	14.00	14.50
25 and 50-lb. kegs	14.25	15.75	14.75	15.75	14.25	14.75
12½-lb. keg	14.50	16.00	15.00	16.00	14.50	15.00
5-lb. cans	17.00	18.50	15.00	17.50	17.00	16.50
1-lb. cans	19.00	20.50	16.00	18.50	19.00	17.50

500 lb. lots less 10% discount. 2,000 lb. lots less 10-4% discount. 10,000 lb. lots less 10-7½% discount.

SOUTHERN STATES

La., New Orleans — The Orleans Demolishing & Supply Co., Inc., 413 North Rampart St., will build a 3 story, factory and office building on a 50 x 128 ft. site on North Rampart St. between St. Louis and Toulouse Sts. Estimated cost, $50,000. R. K. Mulnix, Secy. and Treas.

W. Va., Fairmont — The Central Automobile Corp. is having plans prepared for the construction of a 2 story, 50 x 120 ft. garage. Estimated cost, $75,000. M. Keenan, Mgr.

MIDDLE WEST STATES

Ill., Chicago Heights—The Railway Steel Spring Co., 30 Church St., New York City, has awarded the contract for the construction of an addition to its factory, here. Estimated cost, $60,000.

Ill., Granite City—The Amer. Locomotive Co., Seymour St., Pittsburgh, plans to construct a locomotive plant, at the intersection of Wabash and Terminal Rys., here. Estimated cost, $15,000,000.

Ill., Springfield—The Chicago & Alton R.R., Transportation Bldg., Chicago, will build a roundhouse and a track shop at Ridgely Yards, here. Estimated cost, $300,000. H. T. Douglas, Jr., Ch. Engr.

Mich., Battle Creek—The Amer. Stamping Co., Burchard St., is having plans prepared for the construction of a 1 and 2 story, office and factory building. Estimated cost, $100,000. J. C. Llewellyn, 38 South Dearborn St., Chicago, Archt.

O., Cincinnati—The Steel Tool Gear & Pinion Co. has awarded the contract for the construction of a 1 story, 45 x 115 ft. addition to its factory. Estimated cost, $35,000.

O., Cleveland—Detello Bros., 3502 Orange Ave., are having plans prepared for the construction of a 1 story, 42 x 135 ft. garage on East 35th St. and Orange Ave. Estimated cost, $40,000. F. A. Azzerello, 2500 East 20th St., Archt.

O., Toledo—The Holt Farm Light Co. plans to construct a 4 story factory. Estimated cost, $300,000. Private plans.

O., Zanesville — The Baltimore & Ohio R.R., 2 Wall St., New York City, will enlarge its shopps here and install new machinery for repairing box and refrigerator cars.

Wis., Baraboo—F. and C. Goolmar plan to construct a 3 story, 60 x 112 ft. factory on Main St., for the manufacture of patented sectional tubular frames, for tents, camps and portable garages. Estimated cost, $55,000. Architect not selected.

Wis., Burlington — The E. and R. Orr plans to construct a 2 story, 60 x 80 ft. garage. Estimated cost, $75,000. Architect not selected.

Wis., Kenosha—The North Side Garage, 603 Milwaukee Ave., will soon award the contract for the construction of a 1 story, 80 x 100 ft. garage on Division St. Estimated cost, $35,000. R. Paine, 733 Fremont Ave., Engr.

Wis., Milwaukee—The Panay Horizontal Show Jar Co., 1102 32d St., has awarded the contract for the construction of a 2 story, 40 x 120 x 125 ft. factory. Noted Dec. 30.

Wis., Two Rivers—Langer Bros. are having plans prepared for the construction of a 2 story, 60 x 95 ft. garage on Jefferson St. Estimated cost, $75,000. G. Froelich, Two Rivers, Archt.

Wis., Two Rivers—R. Suettinger plans to construct a 2 story, 60 x 90 ft. foundry, on 16th St., for the manufacture of sheet metal. Estimated cost, $75,000. Architect not selected.

WEST OF THE MISSISSIPPI

Col., Denver—The Chicago, Burlington & Quincy Ry., 547 West Jackson Blvd., Chicago, has purchased 160 acre tract in north Denver, and is having plans prepared for the construction of new shops.

Ia., Davenport — The Crane Co., 600-24 East 4th St., manufacturers of steamfitters' supplies, is having plans prepared for remodeling buildings at 213 East 2d St., and constructing machine shop and two 3 story buildings, on Front St. Estimated cost, $225,000. W. T. Cotton, Mgr. Architect not announced.

Minn., St. Paul — The Bd. Educ., City Hall, is having plans prepared for the construction of a 3 story, 70 x 130 ft. school, to include manual training shop, on 14th St., between Jackson and Roberts Sts. Estimated cost, $200,000. C. A. Hausler, City Archt. L. S. Ferguson, Comr.

Mo., Joplin—The Machinery and Supply Co., 317½ Joplin St., is building 3 warehouses and a 1 story, 40 x 160 ft. machinery plant on 4th Ave. and School St. Estimated cost, $15,000.

Tex., Houston—The Southern Pacific Ry., plans to rebuild its shops here, which were destroyed by fire. Loss, $1,000,000. H. M. Lull, Houston, ch. engr.

WESTERN STATES

Cal., Los Angeles—F. Fallas has awarded the contract for the construction of a 1 story, 80 x 120 ft. garage on Central Ave. Estimated cost, $26,000.

Cal., Los Angeles — P. L. Wilson, 631 South Sprague St., has awarded the contract for the construction of a 1 story, 140 x 150 ft. garage and store on 7th and Bonnie Brae Sts. Estimated cost, $18,000.

CANADA

Ont., Chatham—The Mack Furnace Co., Detroit, Mich., has purchased the factory of the Defiance Iron Wks., here, and plans to remodel, build additions and equip same for its own use. Estimated cost, $20,000.

Ont., Cyrville—The Canadian Pacific Ry., Windsor St., Montreal, Que., plans to build roundhouses, sheds and repair shops, here. J. M. R. Fairbairn, ch. engr.

General Manufacturing

NEW ENGLAND STATES

Mass., Everett—J. Briggs & Co., Inc., 45 Purchase St., Boston, manufacturers of paint, has purchased a 3 story building on Paris St., here, and plans to remodel and equip same for its own use. Estimated cost, $25,000.

Mass., Holyoke—The Farr Alpaca Co., Jackson St., is having plans prepared for the construction of a cotton warp building at its plant. S. M. Green & Co., 293 Bridge St., Springfield, Archts. and Engs.

Mass., Woburn—F. C. Parker & Son will rebuild their tannery which was recently destroyed by fire. Loss, $200,000.

R. I., Pawtucket Valley—The Interlaken Mills, Phenix, plans to construct a 1 story weave shed, here, for the manufacture of textile goods. Architect not selected.

R. I., Providence—The Ward Baking Co., 461 Eddy St., will soon award the contract for the construction of a 2 story, 51 x 116 ft. addition to its bakery. Cost between $50,000 and $60,000. C. B. Comstock, 110 West 40th St., New York City, Archt.

MIDDLE ATLANTIC STATES

N. J., Mercer—The Barber Asphalt Paving Co., 2 Land Title Bldg., Philadelphia, Pa., has awarded the contract for the construction of a power house, manufacturing plant and machinery building, here. Noted Nov. 18.

N. Y., New York (Borough of Brooklyn) —The Metropolitan Macaroni Co., 110 Waterbury St., will build a 1 story, 25 x 115 ft. factory on Maeyer and Waterbury Sts. Estimated cost, $40,000.

Pa., Johnstown—The Gallager Ice Cream Co. is having plans prepared for the construction of a 3 story, 98 x 100 ft. ice cream plant. Estimated cost, $150,000. McCormick Co., Century Bldg., Pittsburgh, Engrs. and Archts.

Pa., Spring City — S. Blum Corp. has awarded the contract for altering a 3 story, 50 x 100 ft. mill building. Estimated cost, $10,000.

SOUTHERN STATES

Fla., Tampa—J. L. Greer, Greer, will rebuild his 100 x 200 ft. lumber mill, here, which was destroyed by fire. Estimated cost, $75,000.

La., New Orleans—The Natl. Brewing Co., c/o C. A. Wagner, pres., 2600 Gravier St., has awarded the contract for converting its brewery on Dorgenois and Gravier Sts., into an alcohol manufacturing plant, and constructing a 1 story, 30 x 75 ft. fermenter building and a 4 story, 30 x 54 x 75 ft. distillery building. Estimated cost, $140,000.

MIDDLE WEST STATES

Ind., Hammond—The J. Campbell Soup Co., Camden, N. J., has purchased the Reed-Murdock plant here and plans to build a huge 6 story building.

Mich., Detroit—The Detroit Packing Co., 40 Bushey St., is having plans prepared for the construction of a 5 story, 110 x 110 ft. addition to its plant. Packers Architectural and Eng. Co., Manhattan Bldg., Chicago, Ill., Archts. and Engrs.

Mich., Detroit—Park, Davis & Co., Atwater St. and McDougall Ave., is having plans prepared for the construction of a 4 story, 100 x 200 ft. drug factory. The above is the first unit of plant expansion, which will cost approximately $4,000,000. Smith, Hinchman & Grylls, 710 Washington Arcade, Engrs. and Archts.

O., Cleveland—The Cleveland Society for the Blind, c/o A. Palmer, 2275 East 55th St., is having plans prepared for the construction of a 2 story, 40 x 80 ft. broom factory. Estimated cost, $40,000. Meade & Hamilton, 1002 Natl. City Bldg., Archts.

O., Youngstown—The Bd. Educ., 16 West Wood St., will soon award the contract for the construction of a 2 story, 250 x 250 ft. high school on Ohio St., to include a wood and metal working shop. Estimated cost, $1,000,000. C. F. Owsley, 1301 Mahoning Bank Bldg., Archt.

Wis., Blackereek—The Outagamie Limestone Co. is having plans prepared for the construction of a plant. J. B. Huhn, Secy.-Treas. H. O. Weldon, 10 La Salle St., Chicago, Ill., Archt.

Wis., Kenosha — The Bruner Dairy Co., 418 Newell St., has awarded the contract for the construction of a 2 story, 30 x 66 ft. addition to its dairy. Estimated cost, $10,000.

Wis., Mauston—L. B. Hoech had plans prepared for the construction of a 2 story, 60 x 150 ft. ice cream factory. Private plans.

Wis., Milwaukee — The South Side Wet Wash Laundry, 641 15th Ave., plans to construct a 2 story, 40 x 50 ft. addition to its laundry. Estimated cost, $10,000. Private plans.

Wis., Neenah—The Wolfax Co., Main St., plans to construct a 4 story, 60 x 150 ft. factory, for the manufacture of pottery and porcelain ware. Estimated cost, $80,000. Architect not selected.

Wis., Seymour—The Seymour Woodenware Co., c/o S. A. Konz, pres., has awarded the contract for the construction of a 2 story, 70 x 136 ft. factory, on Main St. Estimated cost, between $35,000 and $50,000.

WEST OF THE MISSISSIPPI

Minn., Granite Falls — The St. Cloud Crushing Plant plans to construct a crushing plant. Estimated cost, $50,000. J. R. Howes, supt. Architect not announced.

Mo., St. Louis—The Axelson Machine Co., Boyle Ave., Los Angeles, Cal., is having plans prepared for the construction of a oil machinery factory, on Walsh St. along the tracks of the Missouri Pacific Ry., here. Estimated cost, $50,000. P. J. Bradshaw, International Life Bldg., Archt.

WESTERN STATES

Idaho, Kellogg—The Bunker Hill and Sullivan M. & C. Co. plans to build an electrolytic zinc refinery. Estimated cost, $1,000,000. F. M. Smith, Dir.

CANADA

N. B., St. George—The New York World Publishing Co., 63 Park Row, New York City, has purchased the plant of the St. George Pulp Co., here, and plans to enlarge same. The plans call for an increased output of from 30 to 100 tons daily.

N. S., Wolfville — The Gaspereau River Light, Heat & Power Co., plans to build a 10 ton dry ground wood pulp mill.

Que., Matane — The Hammermill Paper Co., Erie, Pa., will soon award the contract for the construction of a plup and paper mill, here. Estimated cost, $1,000,000.